May 1983
vol. 9, no. 5
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A User's View of Prestel

creative computing®

the #1 magazine of computer applications and software

Security: Keeping Your Computer Safe

In-Depth Evaluations:

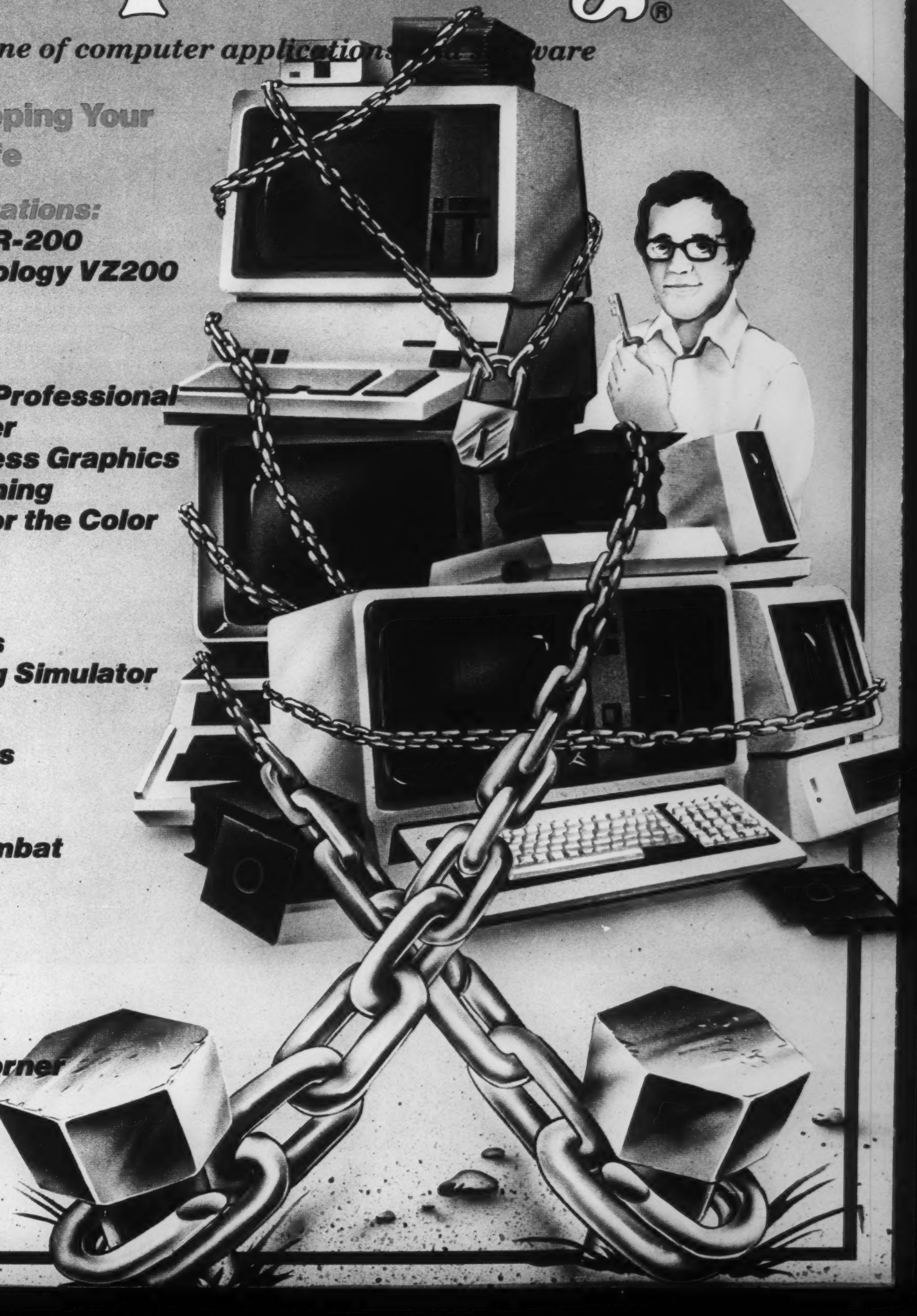
- Panasonic JR-200
- Video Technology VZ200
- TI 99/4A
- Texnet
- Modem80
- Z-Term, The Professional
- Micro-Courier
- Apple Business Graphics
- Visicalc Training
- Databases for the Color Computer
- ValForth
- Prism
- Apple Games
- Atari Landing Simulator

Applications:

- Cryptanalysis
- Sorting
- Doomsday
- Medieval Combat

Columns:

- IBM
- Atari
- TRS-80
- Commodore
- Controller Corner



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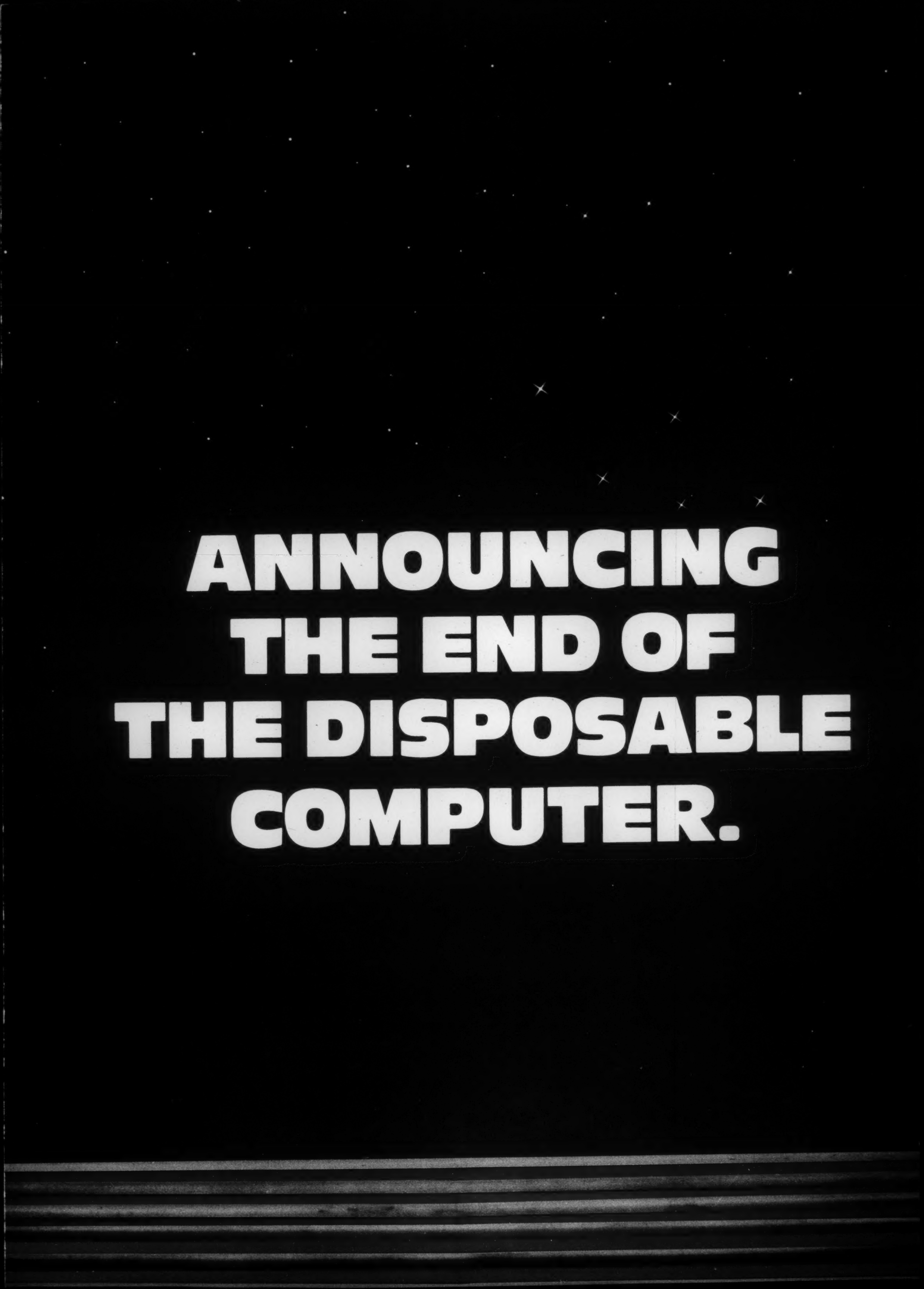
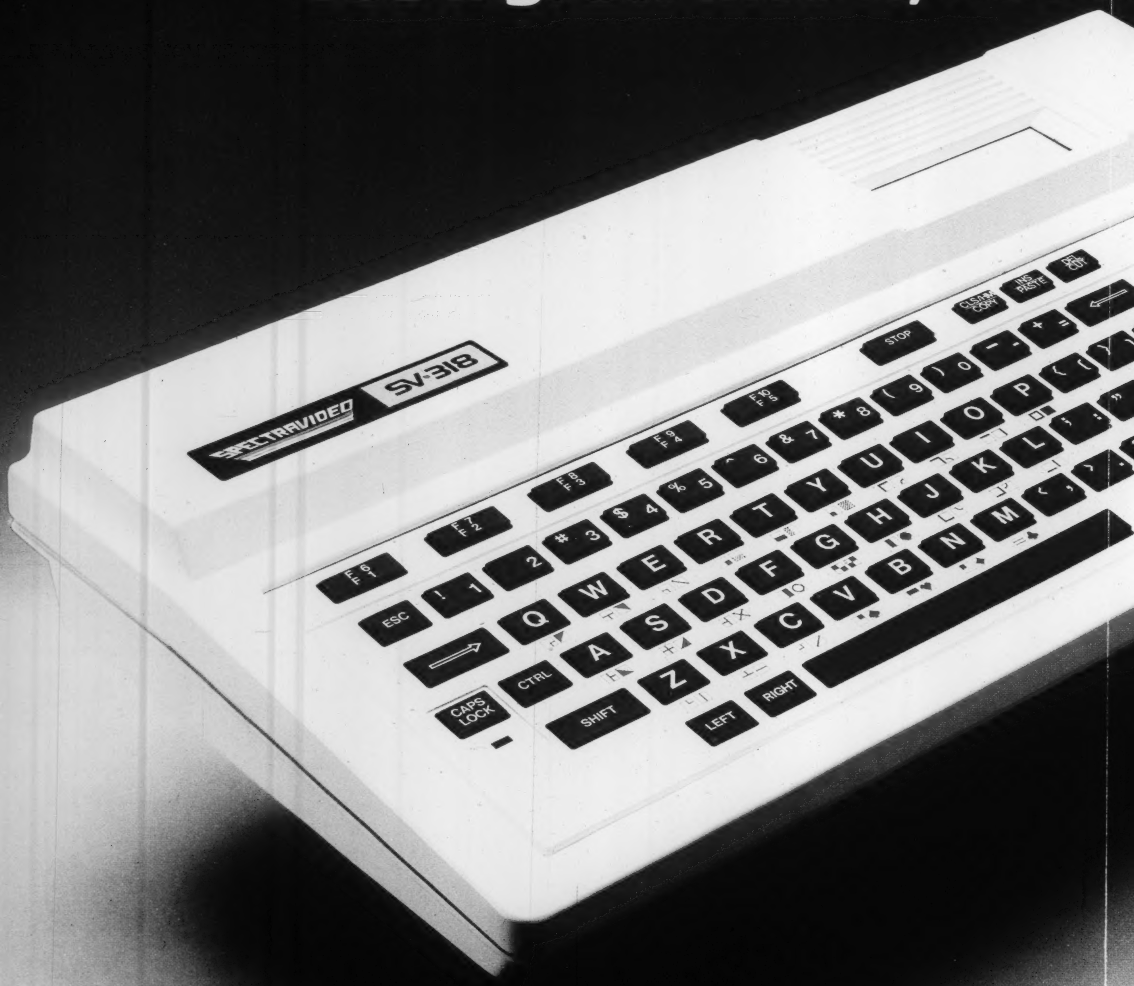


ANNOUNCING
THE END OF
THE DISPOSABLE
COMPUTER.

THE REMARKAB
SV-318 PERSONAL CO

You'll grow into it, not ou



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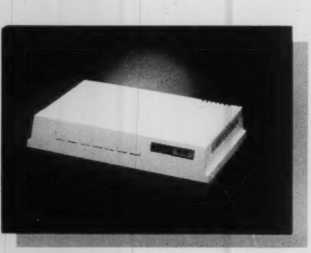
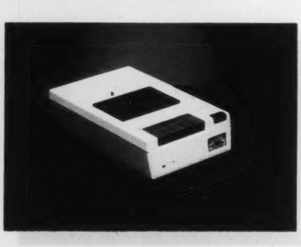


SV-601 SUPER EXPANDER

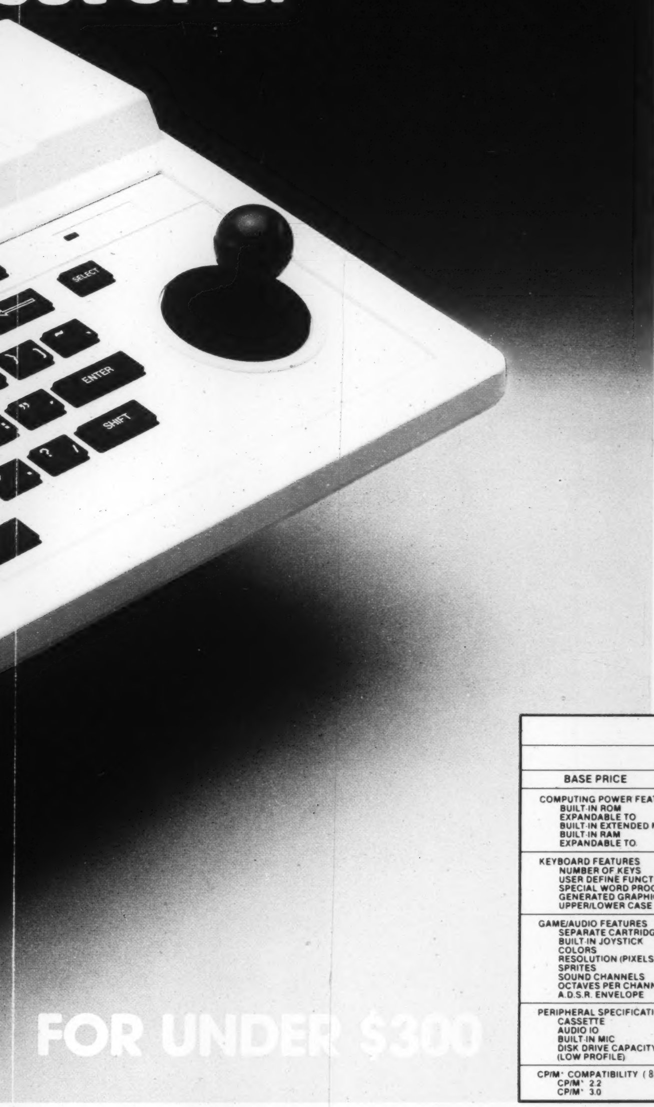
The real value in any computer system lies in its ability to accommodate a large variety of input/output devices simultaneously. With the addition of the SV-601, the SV-318 can interface with as many as seven different devices at one time. Although lightweight, the SV-601 can support a 15" T.V. monitor. Special front view slots have been designed to monitor the operation of the different interface cards that are connected to the system.



SV-903 DATA CASSETT

This feature packed data cassette draws
power from the SV-318, to which it is hand
connected. By using a stereo head, you c
data on one channel, and voice or sound
other. This greatly enhances the usage of
stored data. Programs such as foreign la
tutorials and voice assisted training can b
and data stored. The data cassette will c
be an integral part of your system even if
choose to expand into a disk drive. The d
cassette even has a built-in condenser mi
you write your own voice support program

BLE
OMPUTER:
out of it.



Man has only recently tested the waters of the home computer age, and he has found the waters to his liking. But with a brain capable of storing several trillion bits of information, he will be continually pushing his new found toy to greater limits. Will his machine live up to this challenge?

Sadly, many personal computers will become tomorrow's junk in the attic. The SV-318 is one that will not. Because as you get better, it gets better. It does so because of its capability and expandability—both far beyond those of any other affordable computer.

CAPABILITY. The SV-318 isn't just more capable. It's much more capable. No other computer at even twice the price combines all these extraordinary features: 32K ROM expandable to 96K; 32K RAM expandable to 144K; Extended Microsoft Basic (the industry standard); even Standard CP/M 80-column capability so you can immediately utilize over 10,000 existing software programs. The SV-318 also has a unique built-in joystick/cursor control—an immeasurably useful feature when it comes to playing your favorite video game.

EXPANDABILITY. As you become more and more skillful with computers, you'll love how the SV-318 "stretches" to meet your demands (and actually leads you in fascinating, new directions). For one thing, all eleven of our important peripherals are available immediately. With most other models, you have to wait months. For another, the SV-318 is beautifully designed to interface with new options as they become available.

AFFORDABILITY. The SV-318 is not only eminently affordable, it's the first true bargain of the computer age! Besides home budgeting, business applications, word processing, programming and self-teaching, the SV-318 is the best entertainment value in town. Not only can you use it with your TV to play hundreds of different video games, you can also use your SV-318 with a TV as a drawing tablet or music synthesizer. In play, as in work, the SV-318 will continually expand to meet your potential.

Whether you're just wetting your toes in computers, or fully asail on the waters, the SV-318 is a computer that will serve you for many, many years. You see, we believe that even in the computer age, you don't become an object of real value unless you're around for a while.

SPECTRAVIDEO SV-318 COMPUTER COMPARISON CHART

	SPECTRAVIDEO SV-318	APPLE II PLUS	ATARI 800	COMMODORE 64	NEC 6001	RADIO SHACK COLOR COMPUTER
BASE PRICE	$299	$1,540	$899	$595	$399	$299
COMPUTING POWER FEATURES						
BUILT-IN ROM	32K	12K	10K	20K	16K	8K
EXPANDABLE TO	96K	N/A	42K	N/A	32K	16K
BUILT-IN EXTENDED MICROSOFT* BASIC	YES	YES	ADDITIONAL COST	NO	YES	ADDITIONAL COST
BUILT-IN RAM	32K*	48K	16K	64K	16K	4K
EXPANDABLE TO	144K**	64K	48K	N/A	32K	16K
KEYBOARD FEATURES						
NUMBER OF KEYS	71	51	61	66	71	55
USER DEFINE FUNCTIONS	10	N/A	4	8	10	NONE
SPECIAL WORD PROCESSING	YES	NO	NO	NO	NO	NO
GENERATED GRAPHICS (FROM KEYBOARD)	YES	NO	YES	YES	NO	NO
UPPER/LOWER CASE	YES	UPPER ONLY	YES	YES	YES	YES
GAME/AUDIO FEATURES						
SEPARATE CARTRIDGE SLOTS	YES	NO	YES	NO	NO	NO
BUILT-IN JOYSTICK	YES	NO	NO	NO	NO	NO
COLORS	16	15	128	16	9	9
RESOLUTION (PIXELS)	256 x 192	280 x 160	320 x 192	320 x 200	256 x 192	128 x 64
SPRITES	32	N/A	4	8	N/A	N/A
SOUND CHANNELS	3	1	4	3	3	1
OCTAVES PER CHANNEL	8	4	4	9	8	10
A.D.S.R. ENVELOPE	YES	NO	NO	YES	YES	NO
PERIPHERAL SPECIFICATIONS						
CASSETTE	2 CHANNEL	1 CHANNEL	2 CHANNEL	1 CHANNEL	1 CHANNEL	1 CHANNEL
AUDIO IO	YES	NO	YES	NO	NO	NO
BUILT-IN MIC	YES	NO	NO	NO	NO	NO
DISK DRIVE CAPACITY	256K	143K	96K	170K	N/A	170K
(LOW PROFILE)	YES	NO	NO	NO	NO	NO
CP/M* COMPATIBILITY (80 column programs)						
CP/M* 2.2	YES	NO***	NO	NO ****	NO	NO
CP/M* 3.0	YES	NO	NO	NO	NO	NO

ETTE

draws its
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, you can record
sound on the
sage of cassette
eign language
g can be used
will continue to
even if you
. The data
nser mic to help
rograms.

SV-902 FLOPPY DISK DRIVE

This extremely compact, low profile unit uses standard 5¼" flexible diskettes. Its single side double density configuration allows a capacity of 256K bytes of data (unformatted). Linked to the Super Expander, the SV-902 is your key to the virtually unlimited scope of CP/M O/S as well as a complete variety of program languages such as LOGO, PASCAL, FORTRAN, COBOL and PL-1.

SPECTRAVIDEO™

SV·318
PERSONAL COMPUTER

SPECTRA VIDEO INC. 39 W. 37th Street, New York, N.Y. 10018

CIRCLE 261 ON READER SERVICE CARD

* 16K user addressable plus 16K graphic support
** 128K user addressable plus 16K graphic support
*** Apple II can accept modified 40 or 80 column CP/M
**** Commodore 64 accepts 40 column CP/M

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YOU WILL NEVER AGAIN HAVE TO WASTE TIME WAITING FOR YOUR PRINTER.

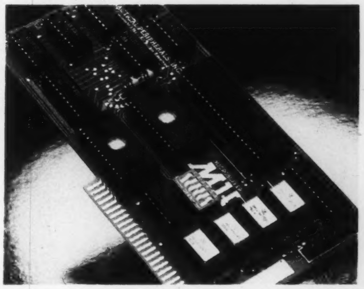
MICROBUFFER ALLOWS YOU TO PRINT AND PROCESS SIMULTANEOUSLY.

Microbuffer will instantly increase your efficiency — and eliminate the frustration of waiting for your slowpoke printer.

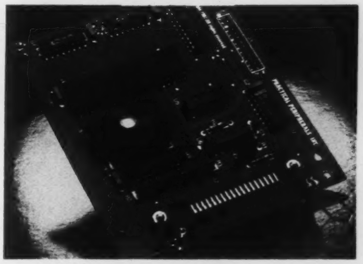
Now you can simply dump your printing data directly to Microbuffer and *continue processing*. Microbuffer accepts the data as fast as your computer can send. It stores the data in its own memory buffer, then takes control of your printer.

THERE IS A MICROBUFFER FOR ANY COMPUTER/PRINTER COMBINATION.

Whatever your system, there is a specific Microbuffer designed to accommodate it.



FOR APPLE II COMPUTERS, Microbuffer II features on-board firmware for text formatting and advanced graphics dump routines. Both serial and parallel versions have a power-efficient low-consumption design. Special functions include Basic listing formatter, self-test, buffer zap, and transparent and maintain modes. The 16K model is priced at $259 and the 32K, at $299.



FOR EPSON PRINTERS, Microbuffer/E comes in two serial versions — 8K or 16K (upgradable to 32K) — and two parallel versions — 16K or 32K (upgradable to 64K). The serial buffer supports both hardware handshaking and XON-XOFF software handshaking at baud rates up to 19,200. Both interfaces are compatible with standard Epson commands, including GRAFTRAX-80 and GRAFTRAX-80+. Prices range from $159 to $279.

MICROBUFFER

ALL OTHER COMPUTER/PRINTER COMBINATIONS are served by the stand-alone Microbuffer In-line.

The serial stand-alone will support different input and output baud rates and different handshake protocol. Both serial and parallel versions are available in a 32K model at $299 or 64K for $349. Either can be user-upgraded to a total of 256K with 64K add-ons — just $179 each.

SIMPLE TO INSTALL.

Microbuffer II is slot-independent. It slips directly inside the Apple II in any slot except zero.

Microbuffer/E mounts easily inside the existing auxiliary slot directly inside the Epson printer.

The stand-alone Microbuffer is installed in-line between virtually any computer and any printer.

MICROBUFFER FROM PRACTICAL PERIPHERALS.

So what are you waiting for? Write to us for more information or ask your dealer for a demonstration.

When you see how much freedom Microbuffer will allow, you'll understand why it's so silly to be without one.

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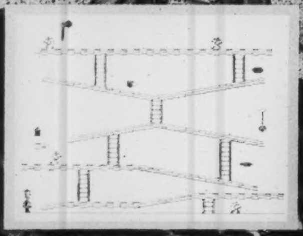
Stake a Claim on the most exciting New Game for your Atari Home Computer.

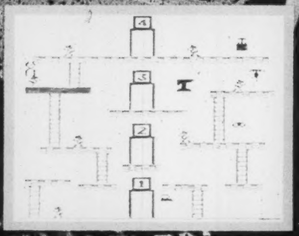
MINER 2049ER
STARRING BOUNTY BOB
XXX
BY BILL HOGUE
Ross

- From the programming team that brought you "Robot Attack", "Defense Command" and many other great Arcade games for your TRS-80™
- 100% machine language
- 16K ROM Cartridge, the largest available anywhere!
- Written specifically for the Atari® — not a converted Apple® game.
- Ten different rounds
- Difficulty adjustment
- High score table
- Demo mode
- Spectacular sound and graphics
- Runs on any 400/800 with at least 16K memory
- Only $49.95

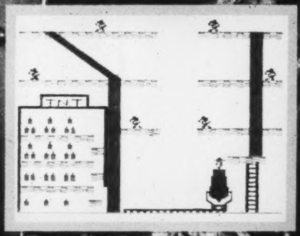
Here are just three of ten rounds in the game:



Round 1: The Mine Shaft.
Sharpen your miner's skill!



Round 3: The Transporters.
Beam yourself up!



Round 10: The Cannon.
Shoot yourself to the top!

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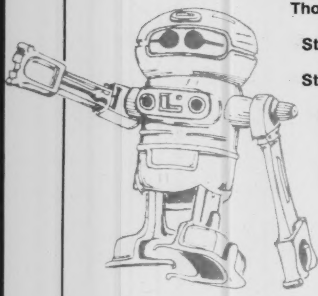

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ATARI SINGS YOUR FAVORITE SONGS!!!

THE Original VOICE BOX Speech Synthesizer by the ALIEN GROUP has received rave reviews:

MICRO COMPUTING–"The VOICE BOX injects an endearing personality to your computer. The possibilities are enormous."

COMPUTE–"The VOICE BOX offers more human-like tones and does not blank out the screen."

CREATIVE COMPUTING–"English text and phonetic code may be freely intermixed rather than requiring separate modes as is the case without exception with every other speech system. A mode called talking face displays an animated face with impressive lip sync animation."

ANTIC–"There is a great potential for teaching children to spell and an added dimension to games overall. I believe the VOICE BOX is well worth the price tag."

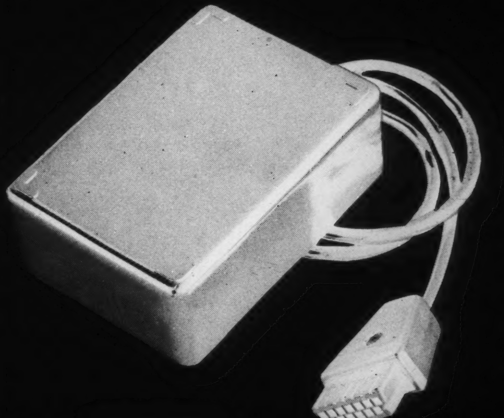
ANALOG–"For ATARI owners who want to add speech to their programs, the Alien Group VOICE BOX is probably the best choice."

POPULAR SCIENCE–"The speech quality is excellent. Besides creating speech, the software has a bit of fun with graphics."

and on the new VOICE BOX II......

TIME MAGAZINE–"Machine of the Year" "The VOICE BOX by the Alien Group enables an ATARI to say aloud anything typed on its keyboard in any language. It also sings "Amazing Grace" and "When I'm 64" or anything else that anyone wants to teach it.

INCORPORATE THE SINGING HUMAN FACE
INTO YOUR PROGRAMS AND GAMES



VOICE BOX II
Speech & Singing Synthesizer

The New **VOICE BOX II** for **ATARI** plugs into the serial port of the **ATARI** 400/800 with sound coming out of the TV/monitor. 48K DISK is required. It has all of the features of the original **VOICE BOX** plus many exciting new hardware and software features:

- The ability to sing with voice and 3 part music.
- A library of 30 famous songs.
- A comprehensive music system that allows the user to easily enter or modify new songs.
- Software that can convert the bottom two rows of the **ATARI** keyboard into a piano with a range of 3½ octaves using the shift and control keys.
- Programmable musical sound effects such as tremolo, vibrato, glissando and click track.
- A singing *human* face with lip-sync animation designed by Jerry White.
- A talking or singing *ALIEN* face with software that allows the user to change the face and 8 mouth patterns as he sees fit.
- The ability to speak with inflection and feeling.
- Can speak in a foreign language with correct foreign spelling as input.
- A talk and spell program by Ron Kramer. Users can program any vocabulary for this spelling game. In fact, this program can even speak in a foreign language like French, where the user must spell the correct word in English, or vice versa.
- **GREEN GOBLINS**–A talking arcade game by John Wilson.
- Random Sentence Generator–An amusing grammar game that helps teach school children to identify parts of speech and recognize a variety of sentence structures.
- **NUMBER SPEAK**–A subroutine by Scott Matthews that converts up to a 9 digit number into normal English pronunciation. Ideal for building your own math games.
- **STUD POKER**–A talking poker game by Jerry White.
- The screen never blanks out while talking or singing.
- Singing or speaking subroutines can be incorporated into your programs, requiring as little as 100 bytes of RAM plus 5 bytes for each word.
- Entries into the $5000 talking or singing game contest can be written using the **VOICE BOX II**–send for contest information.
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CIRCLE 107 ON READER SERVICE CARD

tput...input/output...inpu

Backsliding

Dear Editor:

Thank you for David Ahl's survey of slide show systems for the Apple ("Make Your Apple Into A Slide Projector," November 1982). With so many presentation packages on the market, the overview will certainly guide business graphics users to the most useful programs.

However, I would like to point out some features which were not described appropriately:

The review states that *Screen Director* can hold only 17 images per disk. In fact, the program has the ability to reduce ("pack") each screen so that it takes up less room on the disk (as much as 50% less). Since text screens fill even less disk space than graphs, a *Screen Director* disk actually can hold 30 to 40 images. With an Apple III and Profile, the number increases to over 200 (*Screen Director* operates fully on both the Apple II and the Apple III).

Unlike *Screen Director*, *Executive Briefing System* cannot display images created by *Apple Business Graphics*.

In addition, users of *Screen Director* may select automatic display times of one or more seconds; the comparison chart lists "5 or more."

Finally, the article states that when using *Screen Director* to print out slides, one must print an entire presentation. In fact, *Screen Director* allows the user to specify one or several slides in a presentation and print out only those.

Thank you for bringing this to the attention of your readers.

David Solomont
President
Business & Professional Software, Inc.
143 Binney Street
Cambridge, MA 02142

Pain In The NEC

Dear Editor:

I read with interest the review of the C.Itoh 8510A and NEC 8023A printers by Joseph Simpson which appeared in your *1983 Buyer's Guide to Personal Computers*.

I purchased a NEC 8023A in December of 1981 shortly after their introduction and have found it to be nearly ideal in every respect as did Mr. Simpson. However, I was surprised when I read Mr. Simpson's remarks that the C.Itoh printer produces better graphics than the NEC. Mr. Simpson explains that this is a result of the NEC being unable to support uni-directional print thereby printing vertical lines with a slight offset of approximately one dot with each pass of the bi-directional print head.

I would like to point out that Mr. Simpson apparently didn't realize that the NEC's "incremental mode" disables the logic-seeking mode and results in uni-directional printing of graphics. This mode can be selected simply by sending the printer an escape sequence code. In the "incremental mode," the graphics are identical to those of the C.Itoh and are truly impressive.

Aside from Mr. Simpson's apparent confusion on this matter, his article appeared to describe accurately the fine features available on these printers. In my opinion, they are two of the best values on the market today.

I might also add that I have found my subscription to *Creative Computing* to be one of the better values in the personal computing field. Keep up the good work.

Tony Bonanno
9 Knoll Ridge Drive
Asheville, NC 28804

Three Ways Of Looking At A Bug

Dear Editor:

I read with interest the article "Three Ways of Looking at a Function" by James Fuller that appeared in the January, 1983 issue of *Creative Computing*. I was able to get most of the equations to yield graphs similar to those illustrated in the article, and to obtain a hard copy on an Epson MX-80 FT connected to an Apple II+ with a Grappler and printer interface.

One finds both the program to save a picture on disk and the one to display it have bugs in them. Line 140 of the save picture should be 140 PRINT CHR$(4); "BSAVE"; A$;",A$2000, L$1FFF". Add line 125 to "display picture"; 125 INPUT "name of picture"; A$.

The program will have to be modified slightly to yield a reasonable graph for the Archimedes' spiral. If line 690 is changed to read For G = 0 to 3600 step I one will obtain a spiral of 3600/360 or ten turns if the X and Y axes are scaled properly.

The equation in the upper left column on page 206 should read $f(x) = \cos(2x) + \cos(x + BB/16)$. Also, on page 20, Figure 5 is incomplete. The bottom part of the plot will "fill in" if the program is allowed to run until it is completed.

George Shellenberger
Associate Professor
Natural Science
The College of the Ozarks
Clarksville, AR 72830

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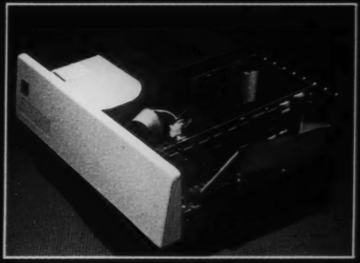

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Eamon Update

Dear Editor:

My article, "Eamon: An Adventure Game for the Apple II With (Almost) Everything," (Jan. '83) contained a typographical error.

On page 98, when discussing the Apple Avocation Alliance, it said that there is "a fee of $27 on your first order or exchange." In reality, this annual membership fee is only $3.

A number of things have changed on the Eamon front since I wrote the article.

Ron Maleika of 3A and John Nelson have been collaborating, and have standardized the catalog numbers of the Eamon adventures. John Nelson has written more adventures and improved the Dungeon Designer Disk. The new version includes a "Save game" feature and allows the use of abbreviated commands.

3A now carries 33 Eamon Adventures, three Eamon Tournament Adventures, the Dungeon Designers' Disk, and two utility disks.

Robert Plamondon
555 SW Jefferson Avenue
Corvallis, OR 97333

Gregorian Can't

Dear Editor:

There are two errors in Daniel Smith's article, "Using Step Functions in Microsoft Basic" (November 1982), but they don't detract from the cleverness or usefulness of his Julian date algorithm. The errors are as follows:

The year 1900 was not a leap year and 2000 will be. According to "The Gregorian Calendar" by Gordon Moyer in the May 1982 issue of *Scientific American*, pages 150-151, "The plan that forms the basis of the Gregorian civil calendar was devised by...Aloisius Lilius... The intercalation Lilius proposed in the *Compendium* was simple: The suppression of three leap days in centurial years not perfectly divisible by 400. The Gregorian intercalation therefore follows the Julian system with the single exception that centurial years such as 1700, 1800 and 1900, which would have been leap years in the Julian calendar, became common years (with the leap day dropped)."

SORRY BOYS, BUT THAT'S NOT QUITE WHAT I WAS LOOKING FOR IN THE WAY OF DIGITIZING.
KV

So in the calendar program the references to 1900 should be changed to 1901; then it can generate calendars up from 1901 through 2099.

Applesoft evaluates true Boolean expressions as 1, not -1. Apple owners will have to change the Julian date algorithm to:

```
J = INT((M=1) * 30.42) + (M=2) - (M>2 AND M<8) + (M>2
AND (INT(Y/4)=Y/4)) + D
```

Dan Meilander
4384 Wolff Drive
Brunswick, OH 44212

IBM Squiral

Dear Editor:

Regarding the article "Why We Really Buy Creative Computing" in the January issue of *Creative Computing*, I am enclosing a listing of the SQUIRAL routine for the IBM Personal Computer. It is very similar to the TRS-80 Color version because the languages are in Microsoft Basic. However, my listing contains the missing line to increment the DISTANCE variable!

```
 0 LISTING OF PC VERSION--SQUIRAL


10 CLS :KEY OFF : SCREEN 1 : WIDTH 40 :COLOR 0,7
20 PRINT  "   BASIC SQUIRAL FOR THE IBM PC " : PRINT
30 INPUT "ENTER DISTANCE  --> ",D
40 INPUT "ENTER ANGLE     --> ",ANG
50 INPUT "ENTER INCREMENT --> ",I
60 PI = 3.14159 : W = PI/180 : SCALE.FACTOR=2
70 'CLS : WIDTH 40 : COLOR 0,ANGLE MOD 2
75 CLS : WIDTH 80                 'HIGH RES VERSION
80 'X = 160 : Y = 100 : A = ANG
85 X = 320 : Y = 100 : A = ANG  'HIGH RES VERSION
90 XN = X + D*COS(W*A)*SCALE.FACTOR
100 YN = Y + D*SIN(W*A)
110 'LINE (X,Y)-(XN,YN),D MOD 3
115 LINE (X,Y)-(XN,YN)           'HIGH RES VERSION
120 D = D + I
130 IF D>200 THEN 170
140 A = A + ANG
150 SWAP X,XN : SWAP Y,YN
160 GOTO 90
170 A$ = INKEY$ : IF A$<>"" THEN RUN
180 GOTO 170
```

The high resolution version is B & W but looks quite nice on a television monitor. The colors, if desired, of the line and the background are selected using the MOD function. The SCALE.FACTOR variable helps to make the squirals more distinct.

I hope others take up the challenge. Keep up your excellent efforts in publishing the best microcomputing magazine in the field.

Thomas R. Hockswender
3173 Meadowridge Ct.
Gibsonia, PA 15044

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CIRCLE 193 ON READER SERVICE CARD

Too Many Backspaces?

Dear Editor:

The article "Input Without Carriage Return/Line Feed" by Tom Disque on page 334 in the December 1982 issue of *Creative Computing* was very helpful to me as I had just encountered the same problem in a program I was writing. I immediately tested the code for its possible use in my program. During this testing I found one important error/omission which needed correcting and two cosmetic improvements which I felt should be passed along to anyone else who plans to employ Mr. Disque's code. These modifications are shown in the revised code of Listing 1.

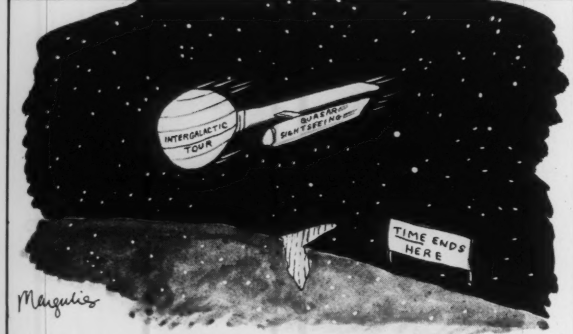
The error is related to the handling of backspace characters (code 8) in line 10020 of the original code. A problem will arise if the first character entered is a backspace or if more backspaces than other characters are entered (i.e., the input is erased). In this case A$ is a null string. When the MID$ function attempts to remove the last character from A$ the length function LEN(A$)-1 returns a -1 value which generates an "Illegal Function Call" error. To correct this problem, a test on A$ must be performed in addition to the test for X=8. This was added by removing all of line 10027 to make the required check and skip the MID$ function when A$ is null.

Listing 1.

```
10000 A$="": PRINT "? "; CHR$(95);
10010 B$=INKEY$: IF B$="" THEN 10010 ELSE X=ASC(B$)
10020 IF X 9 AND X 14 PRINT CHR$(8);: RETURN
10023 IF X=24 PRINT STRING$(LEN(A$)+3,CHR$(8));: GOTO 10000
10027 IF X  8 THEN A$=A$+B$ ELSE IF A$="" THEN 10010 ELSE
      A$=MID$(A$,1,LEN(A$)-1)
10030 PRINT CHR$(8); B$; CHR$(95);: GOTO 10010
```

The first cosmetic improvement causes the routine to resemble the standard INPUT statement in operation. To do this, a question mark, blank and underline (code 95 for a cursor) are printed by line 10000 at the point where input is to begin. When the entered character is printed in line 10030 it is preceded by a backspace/erase (code 8) to erase the previous cursor and it is followed by a new cursor character. Finally, when the carriage return is found by line 10020, a backspace must be printed to remove the last cursor after the end of the input.

The second cosmetic improvement implements the shift-back arrow entry for an erase line command. This is handled by a new line 10023 which identifies the entry (code 24) and then issues a string of backspaces long enough to erase all of the characters printed by the routine. When this is done the routine will start over again.



"... and directly below us, folks, the original 'nick' of time..."

Despite the high values of the line numbers shown in this code, it should be located as early as is possible in the program so as to minimize the time between executions of the INKEY$ function. Even if this is done, the input controlled by this code will be slower than that of an INPUT statement and even a moderate typing speed could cause it to drop some characters.

As a final note I believe a quick clarification is in order regarding Mr. Disque's comment about testing for control codes of 10 through 13 as a carriage return. The Reference Manual lists both 10 and 13 as "line feed/carriage return" with 11 and 12 as "top of form (with line printers)". A simple test program (see Listing 2) will show the code values of the possible inputs from the keyboard. A code of 10 is produced by the down arrow key and actually represents only a line feed. A code of 13 is produced by the Return key and represents only a carriage return. Confusion over the exact functions of these control codes is very easy due to the lack of consistent correspondence between the TRS-80 control codes and the ASCII control codes and due to the minimal explanations in the manual. The test of X between 9 and 14 is valid, however, since I have found no way to produce the 11 or 12 codes from an unmodified keyboard.

Listing 2.

```
10 A$=""
20 PRINT "?";
30 A$=INKEY$
40 IF A$="" THEN 30
50 PRINT "-"; A$; "- "; ASC(A$)
60 PRINT
70 GOTO 10
```

David H. Ternes
695 Kennedy Dr.
Bloomfield, IN 47424

Zapping SuperScripsit

Dear Editor:

In his review of *SuperScripsit* in your February 1983 issue, Dan Robinson comments that *SuperScripsit* will not function with operating systems other than TRSDOS. Apparat, Inc. wishes to announce that we have zaps available to let *SuperScripsit* operate under Newdos/80 Version 2.0 for the Model I and Model III TRS-80. We have sent these zaps to Dan Robinson since he submitted his review to *Creative Computing*.

In addition, Apparat now offers a printer driver to allow the use of *SuperScripsit* with the Epson printers that have the Graftrax-Plus ROM installed. This includes both the Epson MX-80 and MX-100. It is available on disk for $17.95 for both the Model I and Model III TRS-80.

Brian L. Uitti
Assistant Manager,
Software Research & Development
Apparat Incorporated
4401 South Tamarac Parkway
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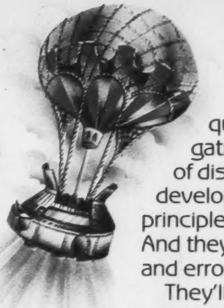

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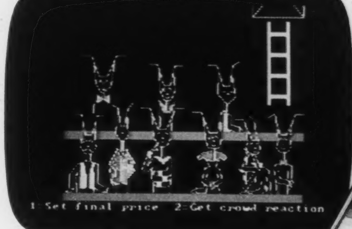

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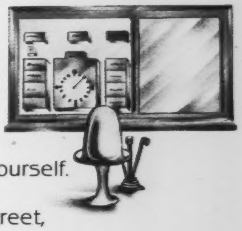

If you're a parent who would rather see your kids reason with aliens than destroy them, you've got plenty of reasons to ask your local software retailer for IN SEARCH OF THE MOST AMAZING THING. It's compatible with Apple,® IBM,® Atari,® and Commodore 64™ computers. And it offers so much fun you'll probably be tempted to play it yourself. Or you can write us directly at: Spinnaker Software, 215 First Street, Cambridge, MA 02142.

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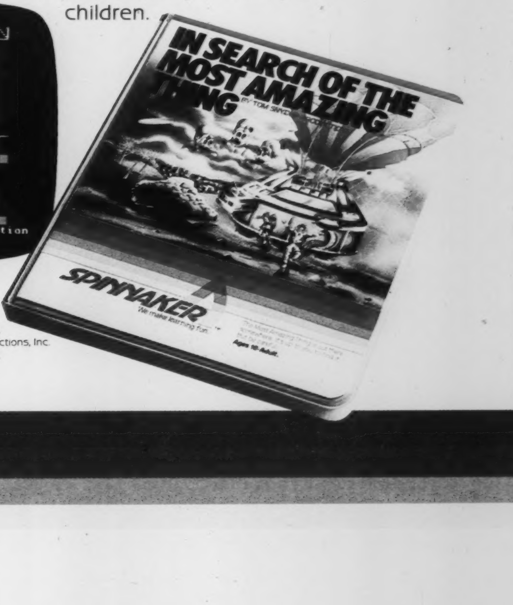

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ow...dateline:tomorrow...da

David H. Ahl

TI Controlling Software Distribution for 99/4A

Program cartridges for the 99/4A contain a GROM chip, or graphics read only memory. All TI cartridges have a GROM even though it is not always needed. Now, TI plans to alter the 99/4A so that cartridges without GROMs won't work.

TI will not license the GROM technology to others, hence those who wish to publish TI cartridge software must now give TI the rights to make and market the cartridges. In turn, TI will pay authors a royalty.

The reason for this is that TI is practically giving 99/4As away (street price $149) so they must make their money from peripherals and software purchased later. So far, Milton-Bradley, Scott Foresman, and Walt Disney have agreed to develop TI cartridges, however, most smaller manufacturers are scaling back any efforts to develop TI software. Imagic, Activision, and Spinnaker all have said they will now concentrate on computers other than TI. Too bad.

ROMs, PROMs, GROMs, EPROMs, and now EEPROMs

You've heard of read only memory (ROM); it holds things that are never altered such as the operating system and Basic language. If you want to create your own ROM, you need a programmable ROM (PROM) into which a program or data can be entered just once. That's not so good for software development, so along came the erasable PROM or EPROM. But to erase an EPROM, it has to be exposed to ultraviolet light for about 15 minutes.

Now, several makers have announced an EEPROM, or electrically erasable PROM. The EEPROM can be erased with a small burst of electricity and reprogrammed up to 10,000 times. The EEPROM probably won't be in your next computer but you may meet one on a future trip to the supermarket. Since it can be reprogrammed by telephone or even radio, it is ideal for holding prices and product codes in electronic scanning cash registers or identification data in air-to-air missiles which must distinguish between enemy and friendly aircraft. Older chips had to be replaced as new aircraft that were not in memory went into service; an EEPROM can be reprogrammed on the fly to deal with new planes.

In the Education Arena

A recent article in the London Times noted that Britain is the first country to have provided almost every secondary school in the country with a microcomputer. During the past 18 months, over 5800 schools took advantage of the "Micros in Schools" program. According to Kenneth Baker, Industry Minister of State, "Every secondary school now has some computer facility and we are the first country in the world to achieve this."

Closer to home, New Jersey Institute of Technology, a leader in computer conferencing, is offering 16 seminars that can be taken via a personal computer or timesharing terminal. Courses cover a wide range of topics and include Alternative Leadership Styles, Apple Basic and DOS, How to Start a Small Business, Mathematics for Financial Investment, Pascal Programming, Technical Writing, and ten others. Since the instructors are hooked in via the same conferencing system as the students, both students and instructors can be located anyplace in the U.S.

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April Foolishness Haunts Us Too

Readers of our April issue may have been startled at some of the ads and product reviews. These appeared in the spirit of April 1st and we hope they provided you with a few chuckles.

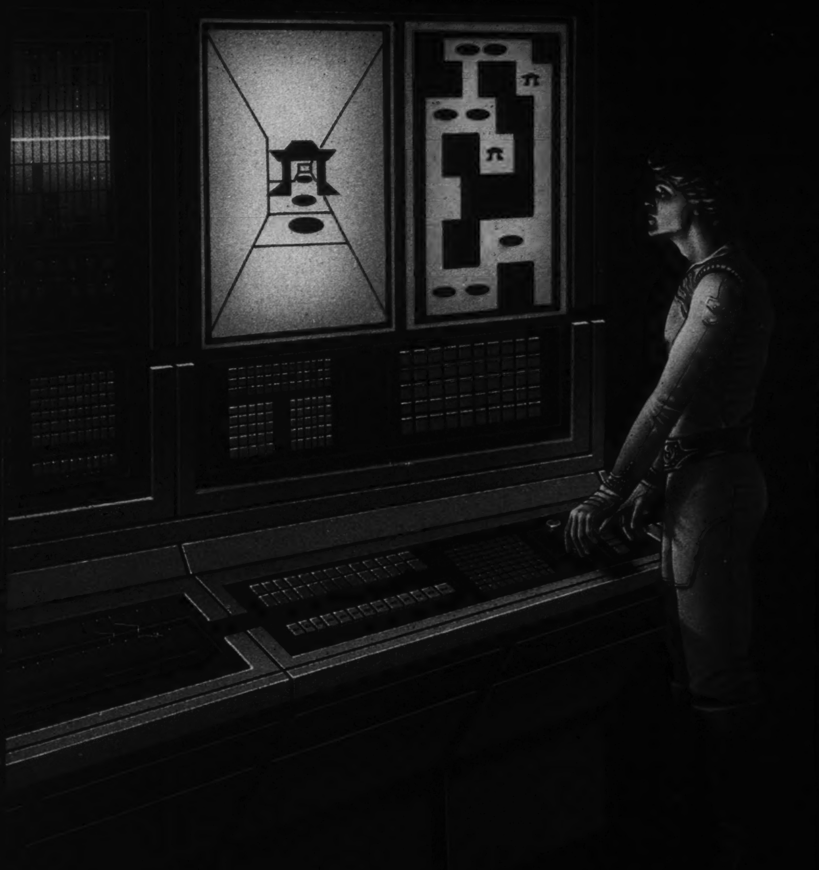
On the other hand, we were startled to see the "screen illustration" on the top of page 100 instead of the lovely colored one we expected to see showing "Sammy, the Sea Serpent," a delightful program in the PDI Preschool Library. Sorry, readers. Sorry, PDI. We'll catch that April gremlin yet.

And Some News Notes

SpectraVideo, who have barely started to deliver their nifty SV-318 computer, have already announced an upgraded version, the SV-328. Major changes include 64K of RAM and an alphanumeric keyboard compared with 32K and an alpha-only keyboard on the 318.

NEC began shipping their new PC-6000 computer at a retail price of $349. The unit has 16K, 71-key keyboard, three channels of sound, color graphics, and a full array of peripherals. NEC Ltd. (Japan) is also supplying 30 entertainment software packages. We hope they're translated.

Tandy will soon announce a Japanese-made, 5-lb. portable computer with full-size keyboard, a screen that can display one-third of a page of text, and built-in word processing software. Many other goodies will be included or available on cartridge for this enhanced version of the NEC PC-8201. Expected price, around $700.



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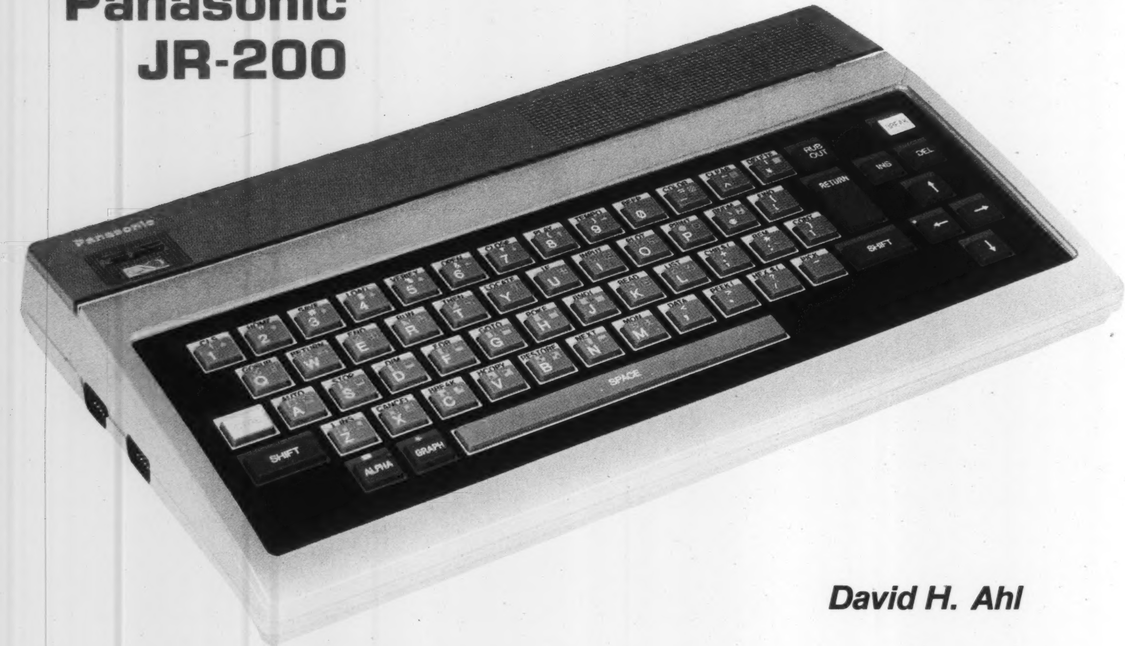
evaluation

Panasonic JR-200



David H. Ahl

The Panasonic JR-200 personal computer from Matsushita has been several years in the making. We have seen versions of it at the last two Consumer Electronic Shows. Now, it is finally being released; it was worth the wait.

Handsome Styling

Outwardly, the JR-200 has modern, pleasing styling. The case measures 13.5" x 8.0" and slants from a height of 1" in the front to 2" in the rear. Made of plastic and finished in silver and matte black in the keyboard area, the case is rugged and durable. We carried it in a fabric tote bag from Las Vegas to Morristown to Phoenix to Orlando and back to Morristown with no ill effects.

The power switch is recessed on the left side of the case; a red power on indicator is on the top right. The power cord is permanently attached at the right rear. In contrast to several other small computers, the transformer and power supply are completely self-contained. Also on the rear of the case are six connectors of various sorts.

Connectors and Switches

Two connectors are provided for the video display. An eight-pin D.I.N. connector attaches to a cable (included) which goes to an NTSC composite video or RGB monitor. An RCA jack provides an RF signal on channel 3 or 4. Interestingly, this signal is provided at a 75-ohm impendence and the supplied 6-foot cable has a quick disconnect F Connector at the TV end. Most current TV sets have a 75-ohm F-type input; on such sets the JR-200 produces a crisp, clear image, almost of monitor quality. For some strange reason this image deteriorates noticeably if this output is routed through a 75 to 300-ohm transformer and fed into standard antenna terminals. This seemed odd so we tried it on five different make TV sets with the same result—outstanding with a 75-ohm F input, mediocre with a transformer.

Another RCA jack provides 8-ohm audio output to an external speaker. Next to it is a volume control which controls both the volume of the external and 1-1/2" internal speakers. Audio power is more than adequate; people in the rear of a 100-seat conference room had no trouble hearing the internal speaker during a demonstration. While JR-200 is theoretically capable of producing tones in the range of 0 to 65535 Hz, only dogs will be interested in sounds in the upper three or four octaves. Realistically, the usable sound range is about five octaves, an impressive achievement in a computer of this size.

A second 8-pin D.I.N. connector is for a cable (included) to a tape recorder. The cable has three jacks for input (earphone), output (microphone), and motor control. A DIP switch on the bottom of the case selects either 600 or 2400 bps. We were pleased to find that the JR-200 performed reliably at 2400 bps on modest quality ($19-$29) recorders over a reason-

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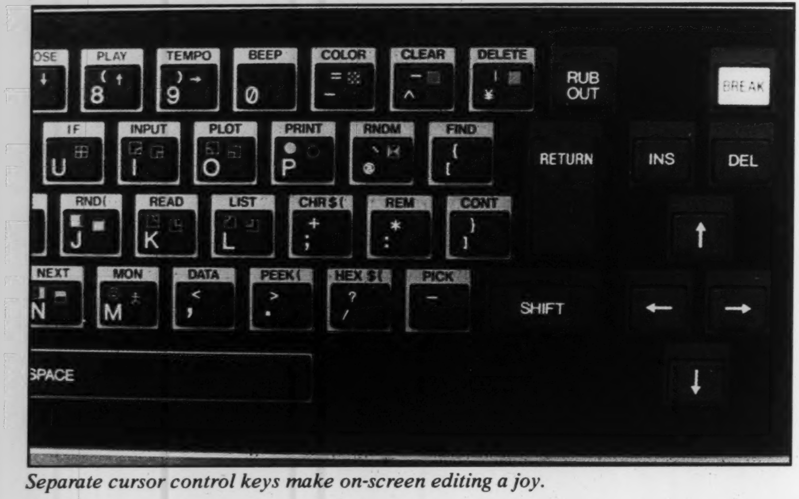


Separate cursor control keys make on-screen editing a joy.

ground and background use: blue, red, magenta, green, cyan, yellow, white, and black.

Sound

The JR-200 is capable of producing sounds ranging from simple to complex. The simplest way of getting a sound is with BEEP 1 which turns on the beeper (880 Hz or A above the middle octave). It stays on until a BEEP 0 is encountered which turns it off.

One step above BEEP is SOUND (P,L) in which P is the pitch in Hertz (0 to 65535) and L is the length of the tone in milliseconds (0 to 255). This is very easy to use in a program.

More complicated are the PLAY and TEMPO commands which permit playing tunes with up to three parts over a 5-octave range at any imaginable tempo. Notes are stored in memory and may be played either in foreground (pauses program) or background (program continues) mode.

JR-200 Basic

As you may have surmised by now, JR-Basic is not Microsoft Basic, but it is not far away either. Most of the commands, statements, and functions are identical or very similar. Rather than going through JR-Basic in detail, we will simply highlight some of the more interesting and novel features.

As expected, JR-Basic has immediate mode and will execute most Basic commands directly from the keyboard singly or in groups (separated with a colon) as long as the maximum line length of 80 characters is not exceeded.

When the JR-200 is fired up, a copyright notice appears along with the number of free bytes. In all configurations, 2052 bytes are reserved for the Basic work area and the remaining RAM is available to the user. We used a 32K machine and thus had 30,716 bytes free. User memory can be expanded to 40K. Basic occupies 16K of ROM while video RAM, I/O and the built-in character set occupy another 6K plus.

A requirement of JR-Basic is that Basic keywords be separated by at least one space or a colon or semi-colon from other characters. While this requirement is imposed by the internal interpreter, it also enhances the readability of finished programs.

Numeric values can range from 2.9^{-39} to 1.06^{38} and are stored and displayed with nine digits of accuracy. Don't ask me how. Both numeric and string variable arrays can have one or two dimensions. Unfortunately variable names are restricted to two letters or a letter and a number.

All the standard operators are available: arithmetic, relational, logical and string concatenation. As expected, LET is optional.

Although the RENUM (renumber) command is listed in the manual, it steadfastly refused to work on the JR-200 we tested.

RUN performs its usual function but can also be imbedded within a program to run another program or to run the existing program from any specified line number, e.g., RUN 480. When used with a filename (RUN "Border"), it will load the program from cassette tape and then run it.

The functions HPOS and VPOS return the current horizontal and vertical position of the cursor respectively. PEEK lets you examine any memory location; its counterpart, POKE lets you put a value into a location. An unusual function is VARPTR which returns the memory location where a particular variable is stored.

On-Screen Editing

A delightful feature of the JR-200 is full on-screen editing. To correct a mistake or make a change you simply list the line or group of lines to be changed, and use the four directional keys at the right of the keyboard to move the cursor to the character to be changed. At this point you can type the change or use the insert, delete or rub out keys to make changes. You then move the cursor to the end of the line and type RETURN. Whoosh; the change is made.

The only time we ran into trouble was when a change extended a line so that it overlapped the next line down. If you are not careful in a case like this, you can wipe out both lines. The solution? Don't press RETURN. Unless program lines are short, the best bet is just to list one at a time for editing or use the LINE INSERT key to open up a new line after the one being edited.

Another handy editing feature is the FIND command. It will search for a string of characters and list the line(s) with that combination of characters. For example, FIND "FO" would list all the FOR statements in a program plus lines containing any words with FO (in caps) in them. LFIND performs the same function but lists the lines on the printer.

Tape Handling and Files

Programs are loaded with either LOAD or LOAD "Filename." A program must be saved with a filename specified.

Files or other material may also be saved and loaded directly from and to memory with the commands MSAVE and MLOAD.

A very handy feature is the ability to load one program at the end of another. This is done using the MERGE command. Of course, if the programs use the same line numbers, only the most recently loaded one will survive.

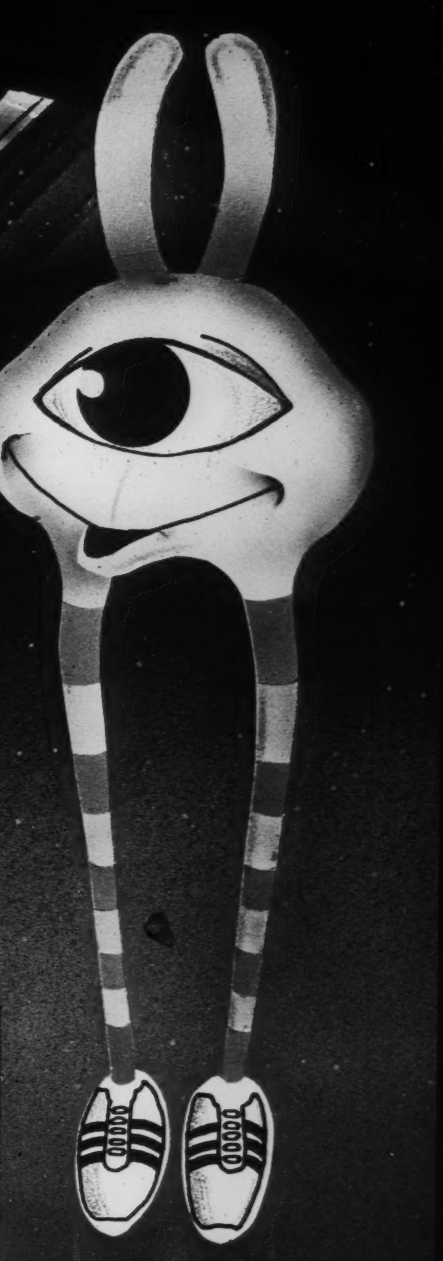
Another handy command is VERIFY which checks to see if a program in memory and on cassette tape match.

Files of data (not programs) may be stored sequentially on cassette tape using the PRINT # command, and read back with the INPUT # command. While sequential tape files are not nearly as handy as random access disk files, the 2400 bps I/O speed is quite tolerable and such files are probably suitable for lists of names and addresses, items in a collection, and the like.

Printed Output

We did not have a printer with our JR-200, hence, we can only note that the manual lists five printer commands. Two are the expected LPRINT and LLIST. A third, HCOPY, generates a copy of the

LUNAR LEEPER



"Lunar Leeper is very addictive, and you'll probably lose hours of sleep over it."

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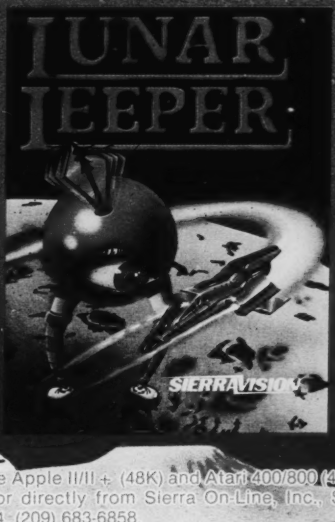

Lunar Leeper is available for the Apple II/II+ (48K) and Atari 400/800 (40K) for $29.95. Order from your local dealer or directly from Sierra On-Line, Inc., Sierra On-Line Building, Coarsegold, CA 93614, (209) 683-6858.

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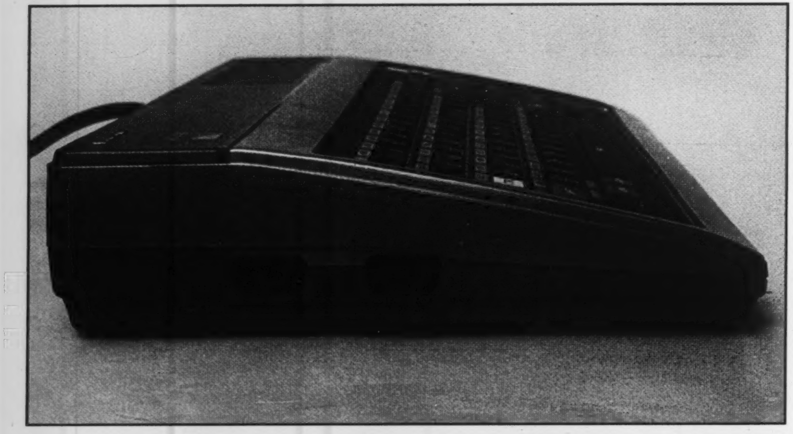

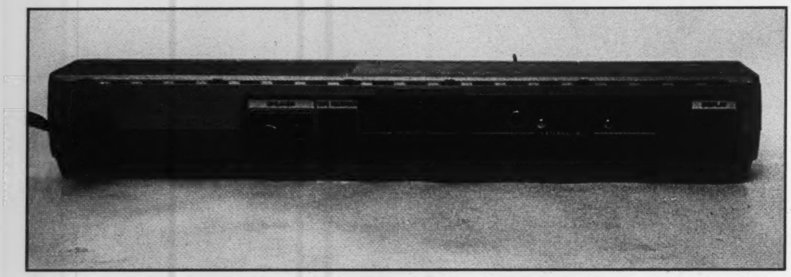

able range of volume settings on standard tape. This is in sharp contrast to many other computers which require precise volume and tone settings on a high quality recorder using premium tape.

Two other connectors on the rear of the JR-200 connect to a printer and external bus. Via this bus, the JR-200 has a serial RS-232C port which may be set up for half or full duplex, 7- or 8-bit words, and odd, even, or no parity. JR-Basic does not use the standard format for RS-232C communications. Although data may be transmitted by using the OPEN-INPUT#/PRINT#-CLOSE statements, the user must develop a routine that will send or receive data on the end of the line. JR-Basic does not have EOF (end of file) when using RS-232C communications.

User-Friendly Keyboard

The keyboard has 63 "Chiclet" style rubberized keys in standard typewriter layout. The keys are 1/2" square and the spacing is identical to a standard keyboard. A full-width (5") spacebar is provided along with two double-width shift keys and a double-height return key. All the keys are in the expected places.

The standard alphanumeric and symbol keys are all matte finished in dark gray, function keys (shift, return, cursor movement, etc.) are blue, and the control and break keys are white.

Each of the gray keys can produce five inputs: an upper- and lowercase letter (or number and symbol), two graphics characters, and a Basic keyword. Two keys, ALPHA and GRAPH, are used to switch back and forth between character and graphics modes. Holding down the CONTROL key while pressing a gray key produces a Basic keyword.

In total, the JR-200 has 253 built-in characters: 96 English letters, numbers and symbols; 5 Greek letters; 63 graphics characters; 79 Katakana (Japanese) symbols; and 10 music and other symbols. All told, this is an exceptionally rich character set, right down to the inclusion of a happy face and stick figure man. All the symbols are formed within an 8 x 8 matrix of pixels.

According to the specifications, it is possible to define your own characters. However, the preliminary documentation we had did not describe how to do this so we couldn't try it out.

Although the keys do not provide any tactile feedback, each keystroke is accompanied by a beep. All keys with the exception of CONTROL, SHIFT, RETURN and BREAK repeat rapidly upon being held down for about two seconds.

Screen Display

The screen display is 32 characters by 24 lines. Each of the 768 locations can be individually addressed with the LOCATE (x,y) command. As mentioned earlier, each symbol and character is formed by lighting pixels within an 8 x 8 matrix, hence by using the correct combination of graphics characters, it is possible to achieve very high resolution images, up to 256 x 192 if you are clever.

Medium resolution (64 x 48) is much more easily achieved by use of the PLOT (x,y) command which permits direct addressing of one-quarter of each character.

PLOT would normally be used in conjunction with COLOR which allows selection of character color, background color and display mode. Four display modes are available: normal, user-defined characters, inverse color of previous characters, and alter background color for positions following the cursor. When we got the hang of it, we found the COLOR command very powerful for producing interesting, and occasionally bizarre, effects. See Figure 1.

Eight colors are available for fore-

```
 1 REMARKABLE PROGRAM BY Dave Ahl
10 CLS                             Clear screen
20 RANDOMIZE
30 I=INT(23*RND(0))                Select starting point between
                                   0 and 23 for rectangle
40 COLOR (INT(8*RND(0)))           Select random color
50 X2=63-I                         Right edge of rectangle
60 Y2=47-I                         Bottom edge of rectangle
70 FOR X=I TO X2
80 PLOT X,I                        Draws top edge
90 PLOT X,Y2                       Draws bottom edge
100 IF X2-X<=16 THEN 130           Tests if length of vertical
                                   sides is too long
110 PLOT I,X                       Draws left side
120 PLOT X2,X                      Draws right side
130 NEXT X
140 GOTO 30
150 END
```

Figure 1. Program shows the use of COLOR and PLOT to produce a series of different colored concentric borders starting at random points in the upper left quarter of the screen. Note the clever way of putting the PLOT statements for all four sides in a single FOR loop.

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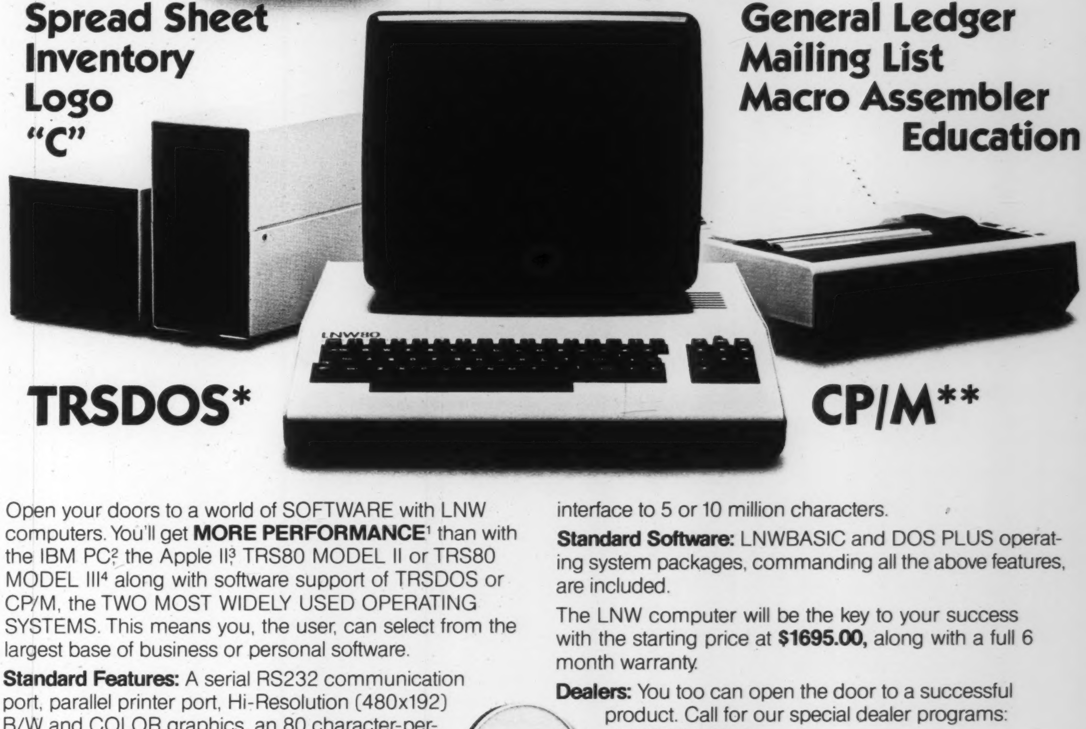

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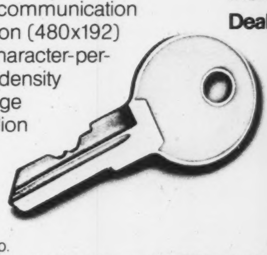

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Panasonic JR-200, continued...

video display on the line printer. This presumably includes graphics, but we can't say for sure.

The last two commands are TAB which tabs over from the left margin and SPC which spaces over from the last cursor position.

Joysticks

The JR-200 has two DB-9 sockets on the left of the case which accept standard Atari-type joysticks. Values from them can be read into programs by means of the STICK function.

Monitor Commands

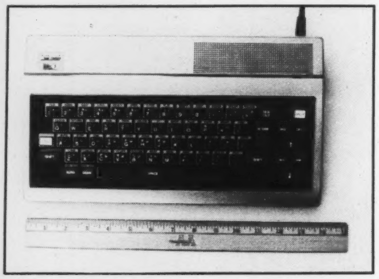
The JR-200 allows machine language aficionados to get into the monitor and the assembly language.

The monitor has only three commands: D, M, and G. D displays 128 bytes of memory from the location specified. M sequentially lists the memory locations from the address specified and allows you to alter them. G begins execution of an assembly language program from a specified address. Memory locations are all in hexadecimal.

Since we had only the scantiest information about these commands and none at all about JR-200 assembly language, we did not check out this feature.

Software and Support

From talking to Robert Zangrillo at Winter CES, we know that Panasonic is sincere in trying to provide support for the JR-200. All the early machines have been put in the hands of software developers such as Datamost, a smart move for getting third party software on the market. Also Datamost has produced a version of their book, *Kids and the Apple*, for the JR-200. Likewise, we are in the process of producing a volume in our ideabook series for the JR-200, *The Panasonic JR-200 Ideabook*.



The JR-200 is a compact 13-1/2" x 8".

On the other hand, the preliminary JR-Basic manual is tough going, has very few programming examples, and could in no way be considered user-friendly. We are told that the Datamost book will be supplied with the JR-200 as the Basic programming primer—probably a reasonable approach.

In Summary

The Panasonic JR-200 is one of the nicest new computers to make the scene in some time. It is attractively styled, is easy to use, and boasts an excellent, if not standard, Basic language. The graphics are very approachable and although resolution is not exceptionally high, the character set is excellent and allows the creation of detailed images. The keyboard is among the best of its type and the separate cursor movement keys make on-screen editing a joy.

The JR-200 is cassette tape oriented and uses it well for program and data storage. We are disappointed that Panasonic does not seem to be moving in the direction of a low-cost compact floppy disk unit.

Peripherals, documentation, software and support are, at this time, question marks although Panasonic appears to be moving in the right direction on all fronts. At the suggested list price of $350, the JR-200 is an excellent choice. ☐

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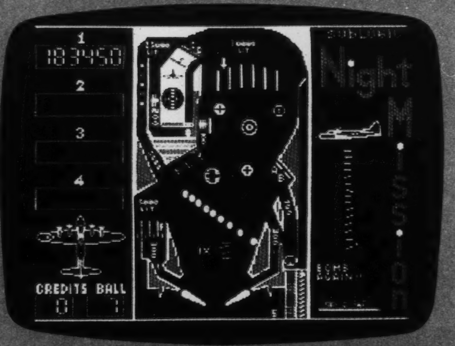

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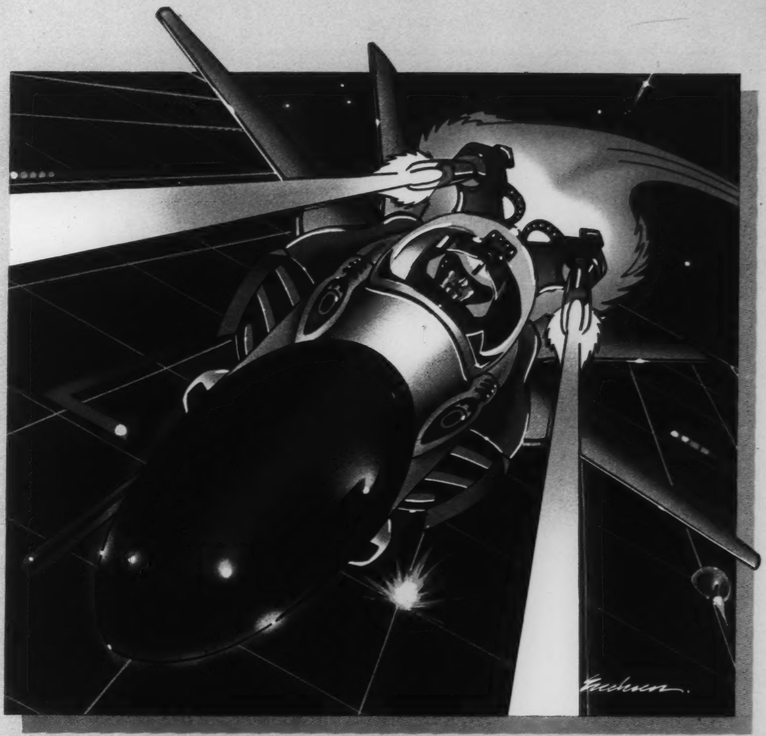

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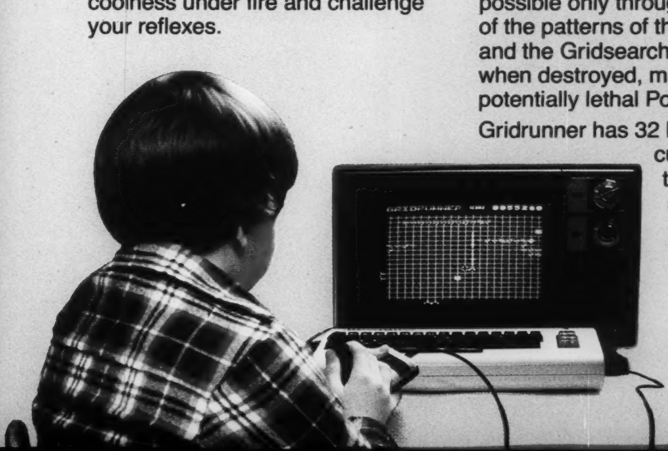
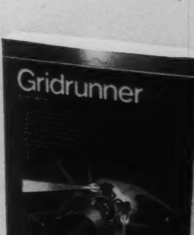
Gridrunner has 32 levels of difficulty (20 levels in the VIC 20 version). To this date, the 13th level has been the highest achieved.



Gridrunner is available for VIC 20, Commodore 64 and Atari 400/800.



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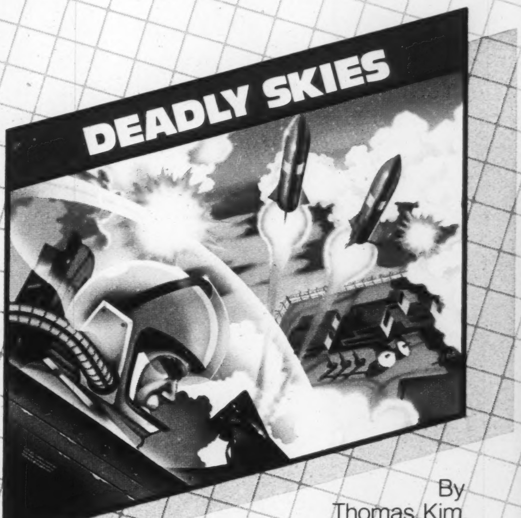

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Video Technology VZ200 Personal Computer

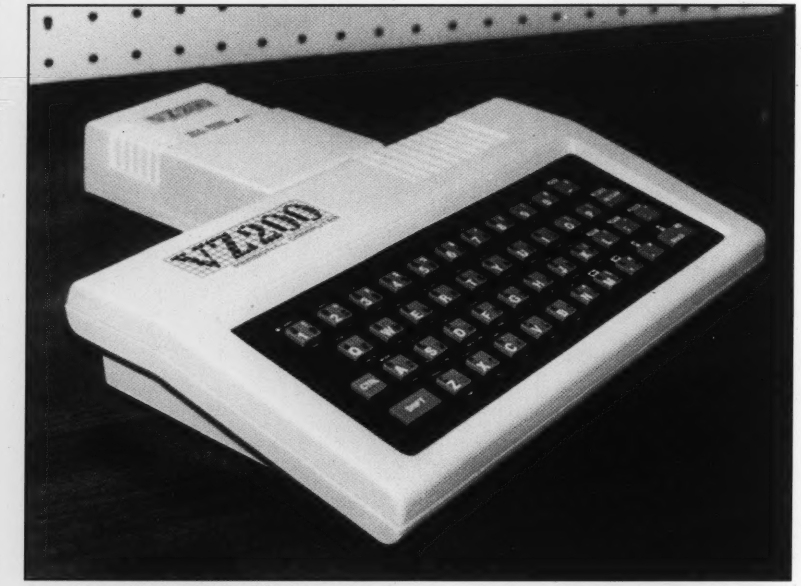
David H. Ahl

The Video Technology VZ200 is a compact microcomputer with a great deal of capability and many unexpected features at a very attractive price.

The VZ200 is based on the 6502 microprocessor, the same one found in the Apple, Commodore, and Atari computers. The 12K ROM memory includes the monitor and an excellent implementation of Microsoft Basic.

The RAM memory included with the basic unit is a sparse 4K. Two plug-in expansion modules are available, one with 16K and the other with 64K. These modules plug into a slot on the back of the computer and extend out about 5.5".

All the Basic commands, keywords, and functions can be produced with a single keystroke.



The VZ200 with 16K RAM memory pack.

The computer itself measures 11.4" x 6.3" x 2". Two-thirds of the top surface is occupied by a keyboard with 45 keys in four rows. The keys are "Chiclet" style rubber and have a very short throw. Touch typing is possible in only a rather limited way. Although key spacing is the same as on a regular typewriter, the rubberized keys have a different "feel." Much more disastrous for touch typing is the fact that there is no space bar; instead a space key is found at the right end of the bottom row next to the period. This also means that there is only one shift key (at the left end of the bottom row). Several other keys do not have the expected characters; for example the question mark is on the L key.

On the brighter side, each key on the keyboard provides several functions in addition to typing a single letter, number, or character. All the Basic commands, keywords, and functions can be produced with a single keystroke by holding down a control or shift key while the key is pressed. This is very impressive. Most other computers which type Basic keywords with a single keystroke can produce only as many words as there are keys, i.e., one keyword per key. Each key on the VZ200, on the other hand, produces two Basic keywords as well as one or two graphics characters. So each key actually has five outputs: two Basic keywords, two graphics symbols, and an alphanumeric character.

When a key is pressed, it makes a short "beep" indicating one keystroke. If it is held down, it automatically repeats with a beep indicating each key entry.

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For the Apple II/IIe

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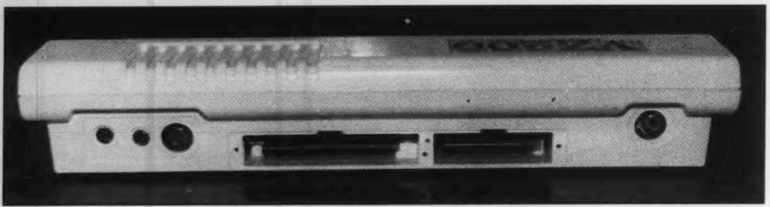

Four I/O connectors and two plug-in slots are on the back.

The top of the computer also has an on/off light. An on/off switch is recessed on the right side of the case.

Peripherals

The VZ200 has an interface to a standard cassette recorder which operates at a Baud rate of 600 bps. This is somewhat slower than other new computers which have rates up to 2400 bps; nevertheless it is twice a fast as machines of just a few years ago. A program that fills the entire 4K of memory with program code takes about 54 seconds to load; a 16K program takes four minutes to load. Bear in mind, however, that most 16K programs do not use 16K of code; much of the memory space is taken by dimensioned arrays and the like.

The manufacturer specifications note that a peripheral expansion bus is built-in, however, we are not quite sure what this means. It appears that expansion modules, which, presumably, can be connected to printers, modems, or other external devices, can be plugged into the back of the computer.

The VZ200 produces two forms of video output: a video signal for a monitor and RF output (on channel 33) for a TV set. It requires 9 volts DC at 800 ma; an AC adapter is included.

Output from the VZ200 can be in one of three modes: text, mixed graphics and text, and high-resolution graphics. In text mode, the VZ200 produces 16 rows of 32 characters (upper case only). Characters can be displayed in regular or inverse video.

```
10 CLS:PRINT "KALEIDOSCOPE  BY
DAVE AHL":PRINT
20 X=1: Y=1: XU=126: YU=62: Z=1
30 INPUT "ENTER 1,2, OR 3";I
40 I=.5*I: J=1
50 MODE (1)
60 X=X+I
70 Y=Y+J
80 COLOR (RND(8))
90 IF X>=XU OR X<=Z THEN I=-I:
SOUND 30,1
100 IF Y>=YU OR Y<=Z THEN J=-J:
SOUND 27,1
110 SET (X,Y)
120 GOTO 60
```

Set hi-res graphics mode

Compute new x and y position

Tests to see if edge of screen has been reached. If so, reverse direction of bounce.

Draw new spot

Figure 1. Program produces a kaleidoscopic pattern of eight colors on the screen. The input parameter changes the incremental amount added to each successive horizontal or X position. Each time the leading edge of the pattern hits a border of the screen, a beep tone is sounded.

Graphics

In mixed mode, text resolution is doubled to 32 x 64 pixels. This is accomplished by dividing each text character into four rectangles. Individual rectangles cannot be addressed. However, 64 graphics character codes define eight characters in eight colors. This gives every combination of the four rectangles in each character. These characters are called with CHR$(128) to CHR$(191). The eight colors are magenta, red, orange, buff, yellow, green, cyan, and blue. If you count black as a color, there are actually nine colors available.

In high-resolution graphics mode, individual pixels can be addressed on a 128 x 64 grid in each of eight colors. To turn on any location, the command SET (x,y) is used; RESET (x,y) turns off any pixel; and POINT (x,y) examines whether a pixel is on or off. Figure 1 is a listing of a simple program that lets a ball bounce around the screen.

By means of the SOUND (P,T) command, 32 notes or pitches (P) are available which can be played over a wide range of time intervals (T).

On-Screen Editing

Full on-screen editing makes it a pleasure to program on the VZ200. To edit a line of code, it is not necessary to invoke an EDIT command or remember a set of editing commands as one must do on the TRS-80 Color Computer and many others. Instead, on the VZ200, the line to be edited is listed, by itself, with the whole program or with a group of lines. By using the four directional keys on the bottom right of the keyboard, the cursor is moved to the character to be changed. You type the change, move the cursor to the end of the line (remember, a key repeats by holding it down), and type RETURN. Voila! The change is made. On-screen editing can also use the DE-

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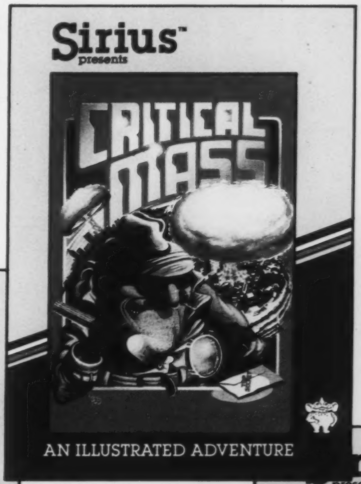
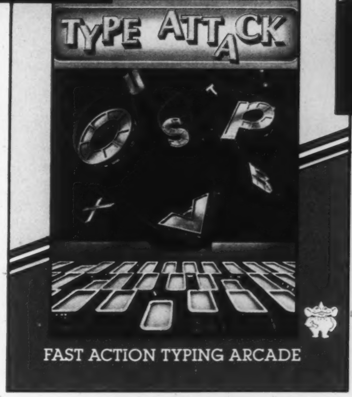


Critical Mass

On Jan. 1st at 10:00 am, the U.N. received this message: "Good Morning, in exactly 9 days, the world's 5 largest cities will be destroyed by thermal nuclear weapons." At 10:03 am, you received this assignment: STOP . . . THIS . . . LUNATIC!

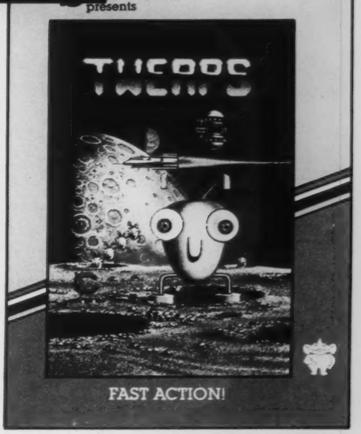
Avail. on disk for the Apple II, II+ or IIe and Atari 800 or 1200 and Commodore 64.



Type Attack

The planet Lexicon is under attack! Letters of the alphabet are falling from the sky. To repel them, you must be able to type the letters faster than they can fall. Be quick! An entire civilization is depending on your skill.

Avail. on disk for the Apple II, II+ or IIe and Atari 800 or 1200, IBM-PC and Commodore 64 and on cartridge for the VIC-20.



Twerps

The boldest space rescue ever! Defenseless Twerps are stranded on an asteroid. You, Captain Twerp, are to board a Twerp-craft, blast through the Orbiters, land safely and rescue your comrades. Beware of the Glingas and Twerp-eating Gleepnites!

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CIRCLE 266 ON READER SERVICE CARD

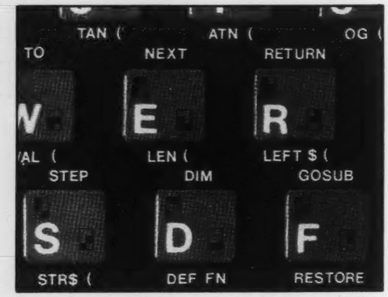
VZ200, continued...

LETE, INSERT, and RUBOUT keys.

We experienced two small problems with on-screen editing. First, the cursor directional keys are activated by pressing the control key on the left and one of the directional keys on the right. It was all too easy to hit the shift key instead of the control key, but this is probably something that one gets used to after using the computer for a few days. The other problem was that after a while the editing buffer seems to overflow and further editing is not accepted. Admittedly, we were trying to push the computer over the brink and it is unlikely that this will be a problem in normal use.

Problems

Speaking of pushing the computer to the brink, we found several things from which there was no way to recover short of turning the computer off. Even BREAK (the equivalent of RESET on some other machines) failed to return control of the computer to the user. The most common irrecoverable condition was LLIST. This would normally list a program on the line printer. However, if no line printer is attached, the computer hangs. This is particularly bad because the rubberized keys tend to bounce a bit and it is very easy to type LLIST instead of just plain LIST. If you have a long program in the computer and have to turn it off because it hangs up as we did four or five times, you are forgiven if you become a bit surly toward the machine.



Each key produces several outputs.

The surest cure is to use Control/4 to list a program. After a while, we learned to do this.

Other things that would hang the machine are all in the same family, in particular, trying to use a peripheral device that is not attached. In some cases, the VZ200 gave an error message, but in some others it went into never-never land.

We did not have an opportunity to try any of the peripherals. The printer interface module, as mentioned earlier, plugs into the back of the computer. It measures 5.5" x 2" and provides a Centronics parallel signal. The Video Technology printer appears to be a Seikosha unit which we have previously found to be a satisfactory, cost effective printer.

Video Technology also promises a full line of software, however, we will reserve judgment on it until we actually see some of the packages in operation.

Summary

All in all, the Video Technology folks in Hong Kong have done an excellent job producing a versatile small computer. We are impressed with the excellent implementation of Microsoft Basic, full on-screen editing, repeat keys, and easy-to-use graphics features. The idiosyncrasies were a bit annoying, but owners will get used to them and will probably not notice them after a week or two of operation. Bottom line: the VZ200 is a great value for the suggested price of under $100.

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Fits completely inside Apple	No	No	Yes
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Warranty period	2 yr	1 yr	2 yr
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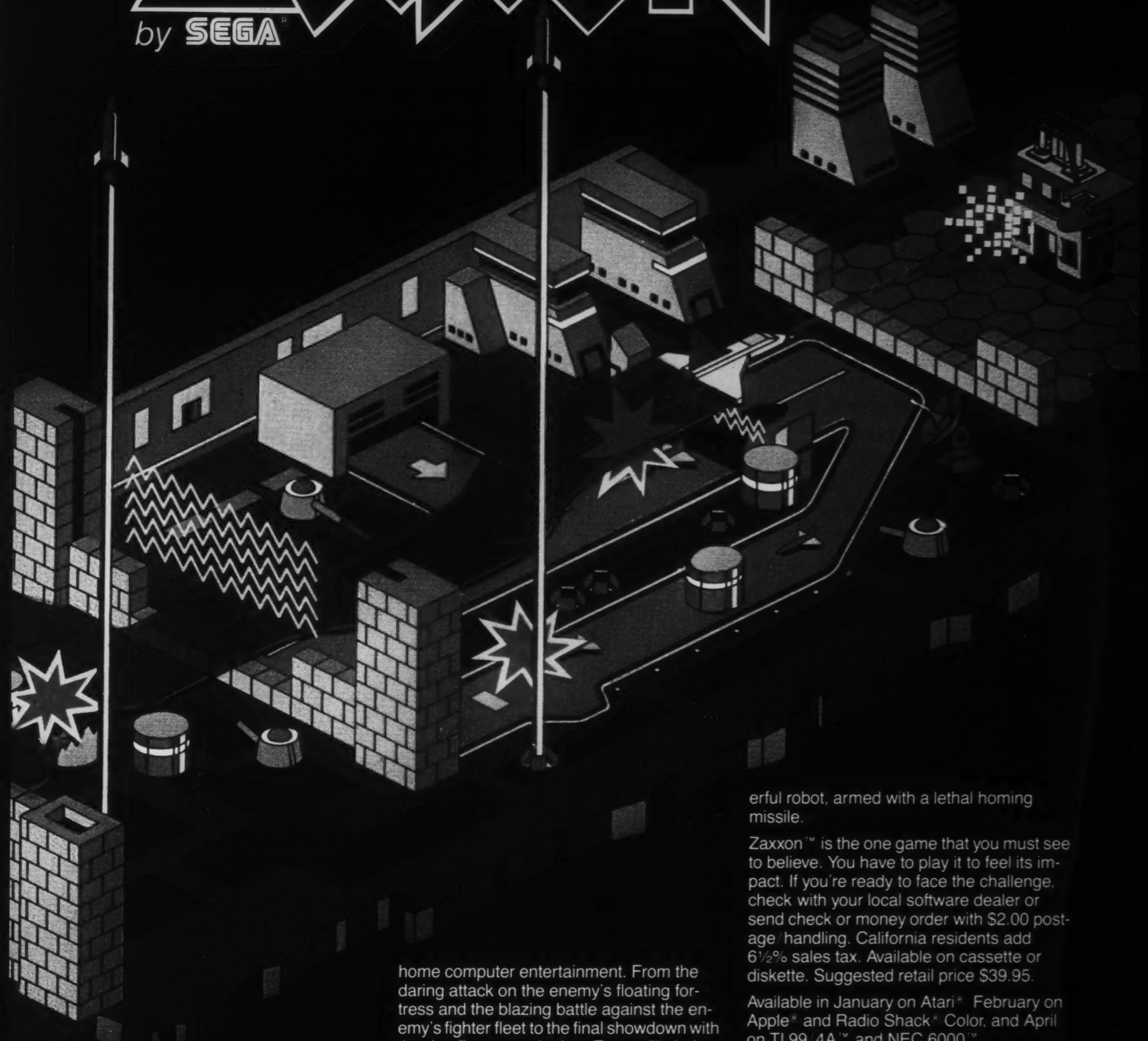
The Official ZAXXON™ by SEGA®



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Zaxxon™ is the one game that you must see to believe. You have to play it to feel its impact. If you're ready to face the challenge, check with your local software dealer or send check or money order with $2.00 postage/handling. California residents add 6½% sales tax. Available on cassette or diskette. Suggested retail price $39.95.

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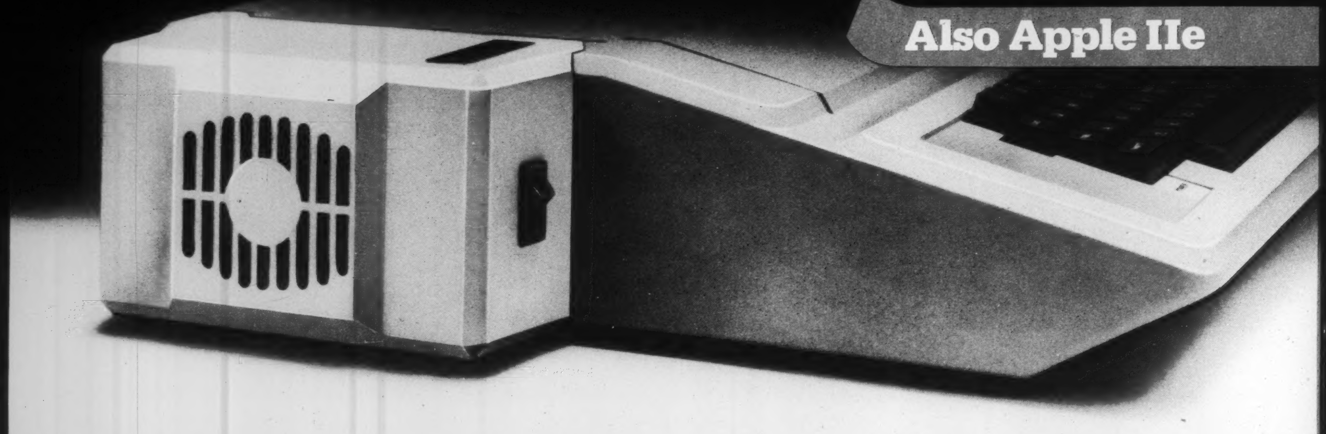

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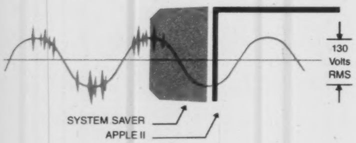

By connecting the Apple II power input through the SYSTEM SAVER, power is controlled in two ways: 1) Dangerous voltage spikes are clipped off at a safe 130 Volts RMS/175 Volts dc level. 2) High frequency noise is smoothed out before reaching the Apple II. A PI type filter attenuates common mode noise signals by a minimum of 30 dB from 600 khz to 20 mhz, with a maximum attenuation of 50 dB.

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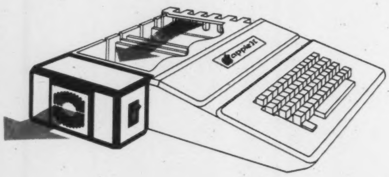

SYSTEM SAVER provides correct cooling. An efficient, quiet fan draws fresh air across the mother board, over the power supply and out the side ventilation slots.

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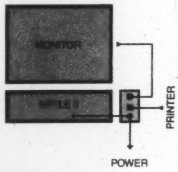

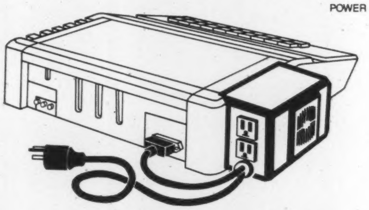

The heavy duty switch has a pilot light to alert when system is on. You'll never use the Apple power switch again!

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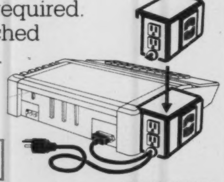

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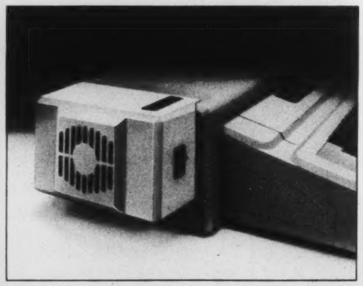

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The TI 99/4A

Fred Gray

The Texas Instruments 99/4, long disregarded or treated with derision by manufacturers and owners of more "popular" computers, has finally come into its own as the 99/4A. With enormous distribution in retail outlets across the country, TI now vies with Commodore and Timex for the top spot on the Consumer Computer Hit Parade. And we expect that the birth of TI's newest offspring, the 99/2, will strengthen the position of the 99/4A. Hence, we take a second look at the TI 99/4.

In the beginning there was TI. And it was big and strong and mighty in the ways of digitals. It had The Watch, and it had The Calculator, and it made more chips than Frito-Lay. But other companies not as big and strong had home computers and were selling them like twinkies. TI looked in its parts drawer and saw a wondrous 16-bit microprocessor that it was most proud of. "We shall make a Home Computer," said TI, and did so.

The TI 99/4 came out in 1979, was small, had calculator buttons for keys, and cost a lot. "See!" said TI, "we have a home computer!" "Hooray!" said the others, "You have a bomb!" And they were right and they were wrong. For the home computer was not a hit and sold like cold cakes, even when the price dropped from Apple Sky to Cheap City.

But under the funny keyboard was a mighty machine with dazzling color graphics and the 16-bit soul. TI looked at the sales figures and said to the engineers: Fix the fool thing and make it live up to the genius inside. And so they did. And so it does. And look out, others.

There were many things wrong with the TI 99/4 when it hit the street. It was much too expensive, it had a calculator style keyboard, it could run only Basic or plug-in modules, and had no expansion capability. These were not oversights, and TI had reasons. The cost was high because it was a new generation of machine and a color monitor came as part of the package. The keyboard came from the TI calculator heritage and allowed the use of slip-on overlays to redefine the keys for special modules. The machine was designed as a home appliance and the home user was not seen as being interested in fancy assemblers or exotic languages. Finally, to keep it com-

TEXAS INSTRUMENTS
TI-99

Fred Gray, 41 Belvoir Drive, Fort Belvoir, VA 22060.

pact and easy for the home user to use, there was no provision for slots or expansion board space; instead, peripherals and expansions were designed into silver boxes to be plugged into the side of the computer.

The price didn't stay high for long. It dropped from $1100 (with mandatory monitor) to under $500 (without it) by the end of 1980. The Basic on board was a good one, full of error-checking and editing capabilities, and considerable graphics capabilities. But the graphics capabilities were slow, too slow to allow anything exciting. True to their promise, TI did bring out expansion modules in silver boxes to plug into an ever-expanding daisy chain at the right side of the computer.

Chief among these was the Solid State Speech box, which gave the 99/4 300 words of highly understandable speech and made it, for a while, the only home computer that could talk.

Still, the 99/4 did not sell, a fact that may have been due to the philosophy of the TI hierarchy. Because the TMS9900 is an unusual microprocessor, and the 99/4 an unusual microcomputer with quite different architecture and I/O, TI decided to leave the fancy programming to their own staff, or to selected large organizations such as Scott, Foresman and Milton Bradley. So they did not publish anything about the workings of the machine and did not offer an assembler, and anyone wishing to do whizbang graphics or anything fast had to get a minicomputer development system, which cost about $50,000.

The result was predictable: practically no one wrote anything for the 99/4. And because the internal workings of the 99/4 were inscrutable and undecipherable, practically no one made any peripherals for it. While creative souls at TI were working hard on modules and peripherals, there were thousands of creative souls among the Great Unwashed who were writing Adventures and Starfights and making superboards and widget controllers for Apples, Pets, and TRS-80s. But not for the 99/4.

"It's a 'menage a trois' - Ralph, me, and his computer."

To their credit, the folks at TI woke up and have rectified virtually all of the problems of the 99/4. The 99/4A is all the 99/4 should have been and more, and now the machine is easier to exploit than ever before.

Hardware Improvements

Let's look at what is different about the 99/4A.

Of course, there is the new keyboard, a sturdy professional one that looks like a computer keyboard. It has a bunch of new keys, offers braces, square brackets, and lower case. It allows any key to be repeated at will, and allows keys to be used in three ways: key, shift key, and function key. Add to this the retained capability to redefine all of the keys through software and the ability of programs to search the keyboard during a run, and you have a most impressive input capability. All that is really lacking is a number pad for quick input of numerical data, which wouldn't have fit on the case.

But there are other changes, deep in the chips and ROMs. One is the use of the TMS9918A Video Display Processor (VDP) in place of the older 9918. To go with it is a revised operating system in ROM that opens up some of the advanced capabilities of both it and the 9900 microprocessor itself, as well as allowing the use of the expanded keyboard.

The TMS9918 is worth a side trip by itself. The VDP is an extraordinary display processor, able to display ASCII characters or user-defined characters in 16 colors on a 24 by 32 grid. More than that, embedded in the chip is the ability to display and move graphics characters called sprites, which can move smoothly across the screen and which, once set in motion by the calling program, continue to move at the specified speed and direction *without CPU attention* until changed by the program.

The VDP creates and moves the sprites based on data stored in the VDP RAM area by the program. By changing data, the sprites can be made to change course, shape, speed, color, vanish, or appear. The sprites afforded an incredible game and moving graphics capability to the 99/4, but because the internal Basic did not support their use, the capabilities were limited to plug-in modules, and not available to the home programmer.

The sprite capabilities of the Computer were opened up through the introduction of Extended Basic, available for both the 99/4 and the 99/4A. This module, adding some 36K of ROM to the on-board Basic, corrects many of the annoying limitations of the original Basic and opens up a wide range of additional capabilities to the machine.

With Extended Basic, the programmer can create sprites in two sizes, set their initial shape, location, velocity, direction, and color; change any of these at will; detect coincidences of sprites with each other or with specified points; change their size and make them vanish or become invisible—all with a simple call to one or more predefined subprograms.

Because the VDP does the work, the main processor is involved only with initiating the action, and the sprites will move as set while the 9900 processor is busy computing other things. Heavy computing by the CPU has no effect on the moving graphics as long as the motion doesn't change, and wild motion on the screen has no effect on the work of the CPU. Since up to 28 individual sprites can be defined and set in motion, the capability for dazzling color animation and games is almost unmatched in the home computer field.

The 99/4A adds another dimension to the sprite graphics not available on the 99/4, bit-mapped graphics. This high-resolution mode is attributable to the 9918A VDP, and provides the capability to do bit-mapped color graphics on a 256 by 192 grid. Now the TI has high-resolution graphics in addition to the sprite capability. Unfortunately, the bit-map mode does not allow the automatic movement feature of the sprites to exist along with the high resolution capability, as the VDP gets a bit overworked. Even with this limitation, the capabilities are astounding. We should see some amazing game and graphics programs soon.

Another capability of the TMS9900 microprocessor has been opened up for the 99/4A through a change to the ROM-based operating system. This is the ability to define up to 16 operations at the assembly level that can be used just as if they were added opcodes for the processor. The effect is to extend the instruction set by 16 and turns the new Assembler/Editor into a Macro Assembler. The ROM change did not take effect with the first bunch of 99/4A units, but is incorporated in the ones coming off the line now.

Editor/Assembler Package

The new Editor/Assembler module is now available for the 99/4A. From a review of the manual I can report that this module plus disk set is an extremely powerful software tool—in reality a minicomputer assembler in microcomputer form. TI has taken their assembler, editor, and linking loader packages developed for the 990 series minicomputers and reshaped them for the 99/4A. This was made possible by the fact that the 9900 and 990 instruction sets are virtually the same. Some of the remarkable capabilities that the Editor/Assembler brings to the microcomputer field are these:

- Writing of relocatable, linkable code. The programmer does not need to worry about absolute addresses and can write his programs as independent subprograms to be linked together later by the loader. By defining certain labels as external references, the loader can match them up and link the programs together, filling in the addresses at load time. This also allows the loader to put the programs into memory wherever they fit best and not be constrained by the present configuration. The computer begins to look more like a minicomputer here. The great advantage for the programmer is the ability to write a library of subroutines, keep them on disk, and bring them into his programs as they are needed without worrying about the addresses or linkages.
- Extraordinary editing capabilities. The Editor is very complete and offers a wide variety of conveniences for the programmer. Some of these are: inserting and deleting characters, inserting and deleting lines, copying whole blocks of code and inserting them elsewhere in the program, moving whole blocks of code around, searching for strings with the option to replace each occurrence with a new string, and a variety of filing commands. The system looks rather like a word processor for assembler code. It makes coding a great deal easier by removing much of the nuisance work.
- Links to Utility Routines. TI has a great variety of utility routines tucked away in both ROM and GROM that are used by the operating system and the interpreters. Access to these routines makes it much easier to do the complicated graphics, sound, and speech routines. The programmer need only load certain parameters in the registers and then call on the utility routine to do the work. This capability is particularly needed with the graphics routines, as this area is rather inscrutable anyway. The utilities give the programmer the ease of programming exhibited by the Extended Basic while allowing the speed of machine-assembled code.

In summary, the TI 99/4A finally lives up to the promises of its makers. With new software and hardware improvements, the TI Home Computer is finally a powerful force in the microcomputer field and should not be counted out. At a normally discounted price of under $300, the 99/4A is an astounding value and may yet make its mark on the microcomputer world. ☐

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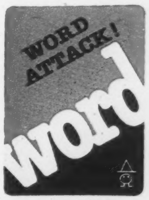

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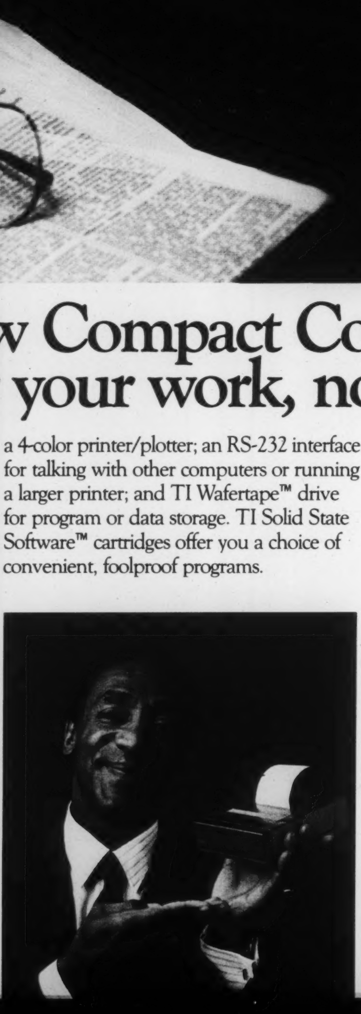

Its built-in language is TI Enhanced BASIC, which allows you to write programs in everyday words. The integrated liquid crystal display shows 31 characters, which can be scrolled to show up to 80 per line. It operates on four AA alkaline batteries that give up to 200 hours of service.

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TEXAS INSTRUMENTS

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CIRCLE 294 ON READER SERVICE CARD

Texnet

Robert Cashman

I bought my TI99/4 because I had always wanted to own a home computer but didn't have any programming experience. Today, I have the ability to hold my own when discussing computers, but no one to discuss with.

Apple, Atari, and TRS-80 owners don't have to look very far for someone to talk to. Most computer outlets sell one of these and can supply information on hardware, software, user's groups, or whatever.

It's different for TI users though, as about the only places that carry the 99/4 or its accessories are mail order houses and retail stores. If you have a question, forget the retail stores. You probably know more than they do.

I suppose I could join a TI user's group, but I live in Massachusetts where there are no user's groups. As a matter of fact there isn't one in all of New England that I know of. I could also join a few clubs in distant locations and communicate by mail, but it just isn't the same.

There is, however, an alternative; it is called *Texnet*, the information service that with Source Telecomputing created a system developed specifically for users of the 99/4 and 99/4A home computers.

When I first heard about *Texnet*, I thought it was too good to be true. First, you receive all the products of The Source—some 1400 different services—everything from electronic mail to catalog shopping, from dining and travel to home and leisure.

> ***Making friends on* Texnet *was great, but what I really wanted was some of that free software.***

But you also get *Texnet*, a service which adds custom features such as:

- TI News
- TI Software Directory
- TI User's Groups
- TI Service Centers
- TI Help
- TI Phonetic Dictionary
- TI Voice Chat
- TI Graphics Library
- TI Music and Sound Library
- TI Idea
- TI Logo Exchange

All of these are terrific, but none can compare with the TI Software Exchange—free software supplied by the International 99/4 User's Group. (Note: software can be downloaded to a disk drive only.)

We all know how difficult it is to find software, but can you imagine getting it for free? Recently, *Texnet* made it possible to upload your own programs to the TI Software Exchange. If even half of the current TI owners would contribute, think of the library of programs we would have to share.

Without giving it a second thought, I decided to subscribe. But first I had to get several accessories. This wasn't a cheap experiment; I needed a modem, an RS-232 interface, and a terminal emulator. I decided to get the TE II for its text-to-speech capabilities, since I already owned a speech synthesizer. In all, those three items cost me about $400. I also had an extra telephone installed for another $50.

The cost for a one-time registration is $100. Once on-line, you incur charges of $20.75 per hour weekdays between 7:00 a.m. and 6:00 p.m., $7.75 per hour evenings, weekends and holidays, and $5.75 an hour from midnight to 7:00 a.m. daily for 300 baud service. Prices for 1200 baud users are $25.75, $10.75, and $8.75 respectively.

Robert Cashman, 692 Lowell St., Lawrence, MA 01841.

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"The documentation is thorough, easily read, and complete."
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SOFTALK — Jan. 1982
"For the home user (and perhaps in some less complex small business), *the best package we evaluated was The ACCOUNTANT by Decision Support Software."*
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Texnet, continued...

I can't tell you how excited I was when I received my ID number and password. No longer did I feel alone. Everything I wanted was at my fingertips, just a phone call away. It's a good feeling to know that you are no longer communicating only with a computer, but with literally the whole world. Some *Texnet* subscribers live as far away as Australia.

Making friends on *Texnet* was great, but what I really wanted was some of that free software, and for that I needed a disk drive. Just as I began to shop around for a disk drive and controller, a classified section for the TI99/4 appeared in The Source POST category. I inserted a "free" wanted-to-buy ad for the things I needed, and got an immediate response and some excellent prices—better than I had seen anywhere. Needless to say, I am now downloading programs.

How difficult is it to access the more than 1400 services on The Source and *Texnet*? It is not difficult at all. When you receive your confirmed application, an extremely easy-to-read user's manual is included. It is a three-ring binder with dividers that allow easy retrieval of subject matter.

Can I find any fault with *Texnet*? Unfortunately, yes. *Texnet* is accessed primarily through two computer telephone networks called Tymnet and Telenet. They are located in over 350 metropolitan areas in the United States. The city that I live in is not one of them. This surprised me as there are approximately 200,000 people living within a ten-mile radius of my city.

The closest city to me with the telephone access line is some 20 miles away, and I have run up some very high telephone bills. I have contacted the local Telenet office (Tymnet did not have an access line) to see when they planned to install a line in my city, I was told that if there was a demand, a line would be installed. Until that happens, I have to be careful not to lose track of time while I'm enjoying *Texnet*.

I did experience a little difficulty while on-line a few times. I was downloading from the TI Software Exchange and lost the carrier signal. This can be aggravating when you are close to completing the data transfer and lose it all. It can take as long as 25 minutes to download a program, so you could end up paying for 25 minutes of on-line time and have nothing to show for it. This has happened to me a couple of times.

Another nice feature of *Texnet* is their terrific customer service. If you should have any problems or questions that the manual can't help you with, you can call a toll-free number and get immediate assistance.

The Source, 1616 Anderson Road,
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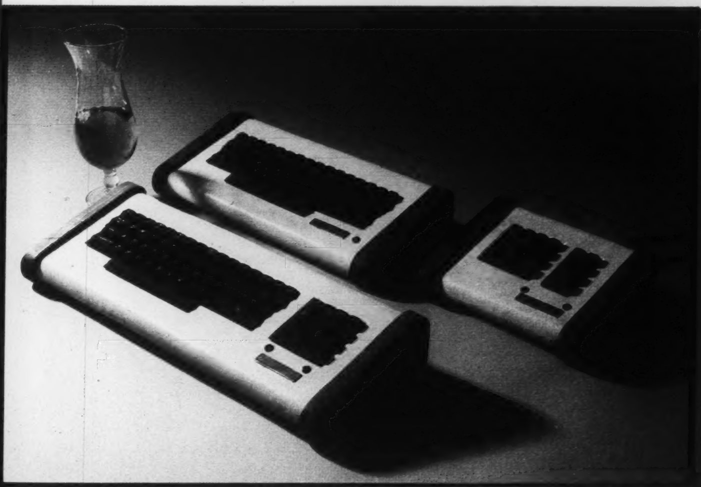

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key permits users to self-test ROM, RAM, audio-visual circuitry and keyboard functionality or call up assistance within complex programs. For even more help, Atari gives you a toll-free number to call for product and technical information (800) 538-8543; in California 1-(800) 672-1404.

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Modem80

Robert Jacobs

Modem80 is a package of communications software for the TRS-80 which is easy to use and sufficiently flexible for all normal computer communications. With this program one may successfully access bulletin boards, other TRS-80s, mainframe computers which permit telephone access, and other brands of microcomputers. Files may be transferred to and from other computers provided they can be set up either to receive ASCII files or to operate under the protocol of the CP/M program Modem.

Files may be sent in their entirety or a line at a time—as for example, to get material into a mainframe text editor such as SOS or TECO. The *Modem80* package—which consists of seven separate programs—is extraordinarily versatile.

Modem80

The main program of the package is MODEM80/CMD. Like the other offerings on the disk it may be copied without difficulty and runs perfectly under TRSDOS, NEWDOS 2.1, NEWDOS-80 (both versions), DOSPLUS, and LDOS. Modem80/CMD loads, initializes the RS-232 parameters, and then presents the user with a menu which lists a variety of activities. By using simple control codes (the CLEAR key is designated as a control switch), you can set the system up to receive or send a disk file, toggle the printer on or off, or transmit some of the characters left off the TRS-80 keyboard. Alternatively, you may switch to the main menu, which offers additional possibilities.

All file transfers are to or from disk; a large buffer is established to which or from which file material is sent. During the transmission, you may query the system and receive a report of file and buffer status. One advantage of this procedure is that files of unlimited length may be sent or received—or, more precisely, the largest files your disk storage system will handle may be received and sent.

Transmission may be interrupted at any time, and it is even possible to break certain kinds of files in the middle and put the remainder on a different disk. Another advantage of a disk-oriented system is that files may be prepared offline, by programs such as *Scripsit,* and saved to disk. Then, should there be some transmission difficulty, the material is still safely ensconced on your disk, ready for another try.

Disk file material may be intermixed with keyboard characters, thus permitting the transmission of data to computers that cannot accept full-speed transmission and which do not use control codes to start and stop the transmission.

Reception of files is nearly as flexible, especially if the sending computer can be set up to respond to control codes, since under MODEM80/CMD the TRS-80 can be set up to use any ASCII control code needed to regulate the sending machine. Control codes may also be used to permit the remote computer to control the file operations.

Two file transmission protocols are available. The first is a handshaking protocol compatible with the widely used CP/M program Modem. As files are transmitted, they are checksummed in blocks, and the checksums verified at either end. Should a block be transmitted incorrectly, *Modem80* automatically retransmits it. Any type of file may be transmitted or received, whether TRS-80 compatible or not. This protocol requires that the remote computer be using a similar program. Should this condition not exist, transmission and reception of files may still take place—but here you are limited to ASCII files. You may send or receive text or Basic programs saved in ASCII under the A option, or a binary file may be converted to an ASCII file by using the utility HEX/CMD, supplied with the *Modem80* package. Thus the limitation to ASCII files turns out not to be a limitation; in fact, HEX/CMD offers a file checksum also, so that you may verify correct reception by comparing the sent version to the received version. And naturally, an ASCII file may be converted back to binary form by the final option offered under HEX/CMD.

The main menu of MODEM/CMD permits a good deal of local housekeeping. The user selects between "echo" and "terminal" modes so that full-duplex

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SOFTWARE PROFILE

Name: Modem80

Type: Communications package

System: TRS-80 Model I, III

Format: Disk

Language: Machine

Summary: Seven versatile telecommunications programs

Price: $39.95

Manufacturer:
The Alternate Source
704 N. Pennsylvania
Lansing, MI 48906

Robert Jacobs, Department of Political Science, Central Washington University, Ellensburg, WA 98926.

Modem80, continued...

transmission may take place between computers (one of the two should be on "echo"). All of the RS-232 functions may be altered from the keyboard by changing local communication parameters. In addition, you can set the system for full or half-duplex, to add linefeeds to carriage returns, to send nulls after carriage returns, to receive graphics, and to print line feeds or not. In short, complete flexibility is offered, and though my description of the program may make it appear complex, it is, in fact, easy to use.

Other Programs

The remaining programs are also interesting. HOST1/CMD allows remote control of the computer, and XMODEM/CMD is a file transfer utility which may be run under HOST1 so as to permit file transfers under the control of the remote computer. Only in this case must both computers be using *Modem80* or other derivative of CP/M.

TYPE/CMD, also included as part of the package, lists a file on the display or printer and may be used under HOST1 to send a file to a remote computer or terminal. TYPE/CMD responds to the XON-XOFF protocol used by so many mainframe computers and thus fulfills a function that XMODEM does not.

The last two programs, SAVE/CMD and TEXTFIX/CMD, assist in the preparation of disk files for transmission. SAVE/CMD allows one to key directly to disk, thus permitting off-line text file preparation. If the user does not have a word processing program available, this utility fills the gap. TEXTFIX cleans up text files by removing control characters so that the received file may be loaded into a word processor. It also has the ability to add the terminal zeroes required by *Visicalc* and *Electric Pencil* files. These are not the kinds to things one uses often, but when you do need them, you need them badly.

Uses

I have been using this package for several purposes. The simplest has been to transfer materials back and forth from friends' TRS-80s and from Model I to III, for which it is ideal. I also access bulletin boards and Micronet occasionally and with complete success.

The most demanding application has been contact with my university's computers—a DEC-10 and a VAX. The flexibility of the *Modem80* package has allowed me to transfer text, Basic, and Fortran files without difficulty.

The author of *Modem80,* Leslie Mikesell, has done a wonderful job on the documentation, and it is clear that a great deal of thought has gone into the design of the program as well. I was most impressed by Mikesell's provision of four translation tables, which permit alteration of all the control codes, establishment of special keys, redefinition of transmitted or display characters and the like. These are the output, video, disk, and printer translation tables. All are readily alterable by the user by entering DEBUG, and although most applications will not require such changes, some will. The ability to make these changes is an important attribute of smart terminal programs.

This package of programs is an excellent value. It will serve the communications needs of practically every user. In several months of heavy use, I have yet to discover a bug in it and have had no difficulty with either specialized or common applications. □

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Computers in Education '83

Computers in Education '83, a conference and summer institute for educators is set for June 20 through July 15, 1983 at Rutgers—The State University of New Jersey. This year's theme is "Necessary Direction for Computer Education: Navigational Aids for the 80's." The focus of the conference (June 27-29) and the four-week Summer Institute centers on microcomputers and other new information technologies and their impact on education at elementary, secondary and college levels.

Included among the featured participants are David H. Ahl, founder and editor-in-chief of *Creative Computing*; and *Creative Computing* contributors and friends Gary G. Bitter, professor of computer education, Arizona State University; Alfred M. Bork, director, Educational Technology Center, University of California at Irvine; Lud Braun, software director, Office of Instructional Development, New York Institute of Technology; Jim Butterfield of Toronto, Ontario, Canada; Sylvia Charp, director of instructional systems, Philadelphia Public Schools; Fred T. Hofstetter, director, Office of Computer Based Instruction, University of Delaware; Dan Isaacson, California State University at Fresno; Arthur Luehrmann, founding partner, Computer Literacy, Berkeley; Seymour Papert, Massachusetts Institute of Technology; Robert P. Taylor, Teachers Collage, Columbia University; and Karl L. Zinn, Center for Research in Learning and Teaching, University of Michigan.

The final brochure, which contains program details, description of the forty short courses in the Summer Institute, and a registration form, will be mailed in late March.

Additional information can be obtained from: Mitchell E. Batoff, Institute for Professional Development, 245 Nassau St., Suite D, Princeton, NJ 08540. Telephone: (609) 924-8333.

Basic Standard

The American National Standards Institute has approved a public comment period for the Basic Standard; it will begin around mid-March and last until mid-July.

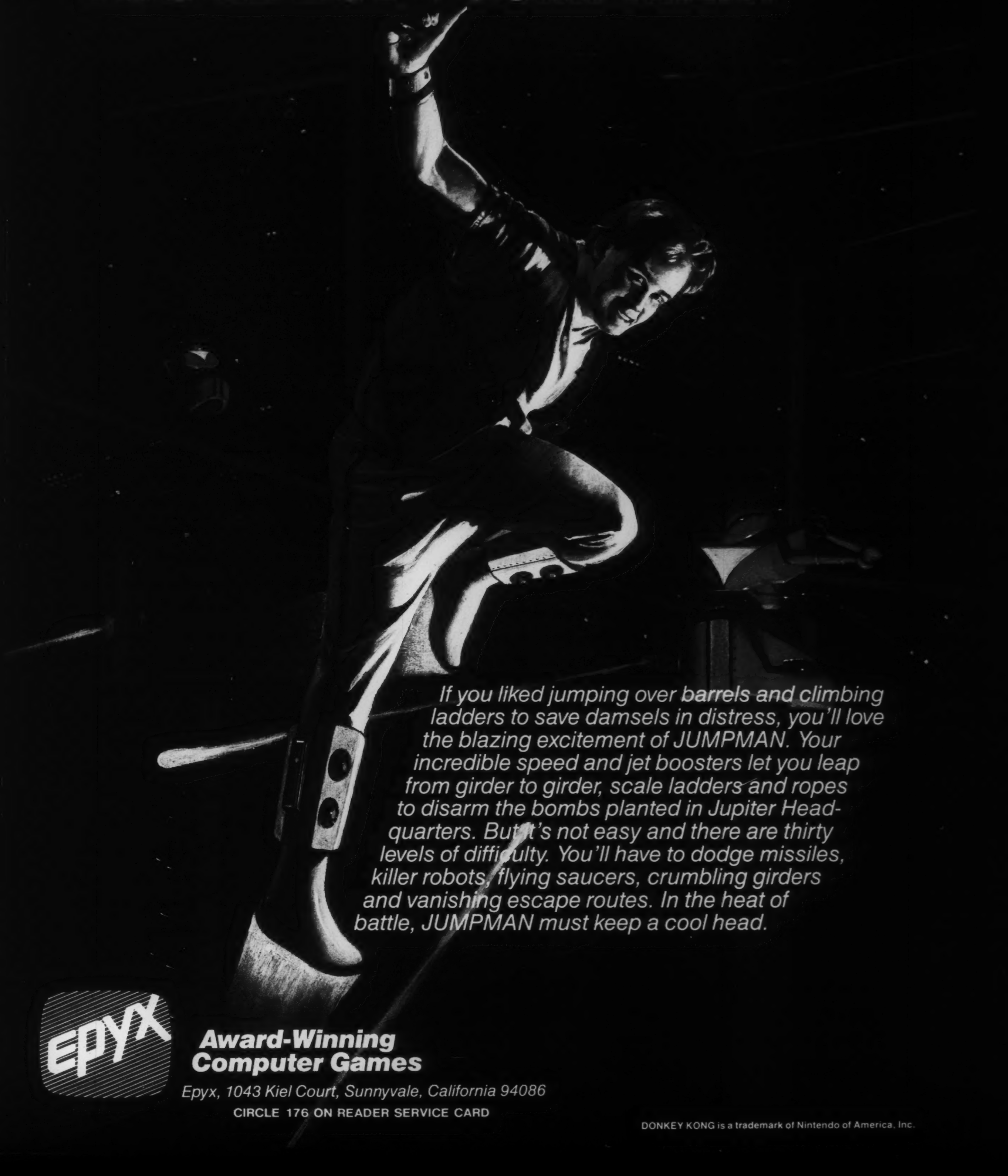
Persons interested in reviewing the proposed standard and commenting on it should write to: X3 Secretariat, CBEMA, 311 First St., N.W., Washington, DC 20001. Ask for document X3J2/82-17 entitled "Proposed Draft for American National Standard for Basic," and enclose a check or money order of $20 for duplicating.

Radio Shack Educational Challenge

Radio Shack, a division of Tandy Corporation, has announced America's Educational Challenge, an opportunity for elementary and secondary school teachers in the United States to achieve a basic familiarity with computers and their use in the classroom.

Information on the program has been mailed to every school principal in the United States. The mailing includes an educator's handbook describing the ways microcomputers are being used in schools, a basic computer literacy package, including spirit masters and teacher information designed for use in a classroom to teach elementary computer concepts, a secondary level textbook on computer programming, information about what several school districts are doing with computers, and an order form which a school can use to obtain two filmstrip audio-visual presentations suitable for conducting teacher workshops and staff development sessions on computer concepts and the use of computers in education.

Also included are several certificates entitling teachers to two free classes in Basic programming and an educator's workshop at one of over 375 Radio Shack Computer Centers. All of these materials will be provided to a school on request and without charge, according to William Gattis, Director of Radio Shack's Education Division.



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CIRCLE 176 ON READER SERVICE CARD

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Z-Term, The Professional

J. Robert McCown

Do you have an Apple II, a Z80 SoftCard with CP/M, and one of the popular modem cards, or a serial interface with an outboard modem? Do you wish you had some decent software to use the combination to connect your computer to the outside world of databases and other computers in just about every way imaginable?

If so, your wish may not only become a reality, but with *Z-Term, The Professional* from Southwestern Data Systems, you may get quite a bit more than you thought was possible. *The Professional*, which we will call *Z-Pro* is certainly everything I wanted in a communications package.

A good bit of the CP/M software available these days is not something that you can buy over the counter in your nearest computer store. Some of it may be up and running on a friend's computer, near or far. There are CP/M bulletin boards all over the country with sophisticated public domain programs written by very competent programmers available for download.

With *Z-Pro*, you can read or download text just as it was originally formatted, including control characters from timesharing systems such as The Source, Micronet, and others. With an external terminal or 80-column board, you can take advantage of the mainframe at your office and use the screen-oriented editor or database.

You can transfer a COM file between your machine and someone else's, or download one from a CP/M bulletin board. With this package, you can transfer text, source code, data files, or encrypted gibberish from one system to the other and make sure it arrives in one piece the first time. You can even have your system answer the phone and do all this for another CP/M system with similar capabilities!

Let's start with a general overview of *Z-Pro*. The package supports most peripheral communications devices at baud rates from 50 to 1200 and can also speak Baudot (the deaf TTY standard) when using the Novation Apple Cat modem.

creative computing

SOFTWARE PROFILE

Name: Z-Term, The Professional

Type: Advanced communications package for the CP/M Apple

System: An Apple II or Apple II+ with 48K RAM, Z-80 SoftCard, and modem card or serial interface with associated modem.

Format: 5 1/4" disk

Summary: Excellent data communications package.

Price: $149 in computer stores, or can be ordered directly from SDS

Manufacturer:
Southwestern Data Systems
P.O. Box 582
Santee, CA 92071
(714) 562-3221

Z-Pro supports all kinds of screen display, ranging from the standard 40-column Apple screen to any 80-column display board or external terminal. Any disk system currently interfaced to your Apple II under CP/M is also supported with no modifications necessary.

If you are using the local Apple keyboard and 40-column screen, provision is made for the generation of lower case and other characters normally not available on that keyboard. In this configuration, however, you must have some sort of lower case board in the computer to be able to view the lower case characters.

With *Z-Pro* you can send or receive ASCII (7-bit) data of any type to most any dial-up system. Files of any size may be sent and files of up to 34K may be received at any one time. The package also supports the Christensen protocol, an established standard among CP/M dial-up systems. This makes it compatible with MODEM, XMODEM (most variations), LMODEM (DEC-10) and CMODEM (Unix). Using this protocol, any kind of file (8-bit) of any size may be transferred with complete checksum and CRC error checking.

Z-Pro supports the PAN protocol (a subset of PCnet) for the sending and receiving of forwarded mail by other *Z-Pro* or PAN systems. The system can be left on-line unattended to answer the phone, receive PAN mail or send and receive Christensen transfers.

You can set up keyboard Macros, including imbedded control characters, to function as mini-programs. At a keypress, you can do such things as sign on to a host system or perform custom handshaking routines with another system.

We will discuss some of the finer points

J. Robert McCown, 4670 W. 63rd Street, Los Angeles, CA 90043.

of the system later on in the article, but let's see what we get on our screen as a menu when we first fire this program up.

Using The Program

After executing the program ZPRO.COM, the first thing we get is the * prompt, which is the indicator throughout the program that asks us for a *Z-Pro* command. Pressing ^Q, which is the single control key we must remember to get back and forth between terminal and command modes, displays the menu shown in Figure 1.

Figure 1.

```
 -MAIN COMMAND SUMMARY-

! = Display program status
C = Clear buffer
D = Dial or connect (if applies)
E = Echo -- duplex full-half
F = Free buffer space
G = Get file from host (protocol)
H = Hang-up (if applies)
I = Disk directory
J = View disk file
L = Change logged disk
M = Macro group select
P = Printer on-off
R = Copy on-off
S = Send file
U = Secondary menu
V = View current buffer
W = Write file & clear buff
X = eXit to CP/M
```

To examine the secondary menu of functions, we type U from the main menu. The result appears in Figure 2.

Figure 2.

```
 -SECONDARY COMMAND SUMMARY-

A = Show control characters
B = Baud rate change(if applies)
K = Terminal chat mode on-off
N = Set delay after c/r (send)
O = Auto-save on-off
Q = Main command menu
T = Transpose ^H/RUB
Y = Set protocol options
      N = No show
      S = Show
           F = File
           R = Received data
           S = Sent data
Z = Screen format on-off
: = Auto-disconnect on-off
@ = Apple CAT voice modes
^ = Apple CAT port switches
+ = Answer phone (if applies)
" = Keyclick on-off
/ = Do CRC
```

A good many of the instructions described here have their own sub-menus and subsequent choices of things that you may want to do, but it is not my intention to duplicate the manual. The manual contains about 125 pages and each of the capabilities of the system is discussed in great detail.

A program called Z-MOD.COM comes with *Z-Pro*. You use this in a kind of DDT fashion to modify various tables and flags in *Z-Pro* to customize the program for your particular configuration. Among the things that can be changed are the defaults for most of the main commands, the flags to control various peripheral devices, and the communications protocols.

In addition, you can configure whatever terminal you are using to look like the terminal that the host computer expects. For the most part, if you have a reasonably common set-up with one of the modems or terminals listed in Figure 3, *Z-Pro* will run as configured when you get it.

With close attention to the manual and some thoughtful planning, you can use the Z-MOD program to create a completely personalized version of the system. With the exception that certain changes must be made for some modems or terminals you can run this package just as it is. *Z-Pro* knows what kind of modem or terminal card you have plugged into your machine and treats it accordingly.

Another program that comes with the package is GO.COM, which can be executed once you have exited from *Z-Pro* to CP/M. Providing you have not run another program or reset the system, you can then re-enter *Z-Pro* with all flags and data intact. This really comes in handy if you want to rename files, change disk files, etc. and continue your session without disconnecting the phone.

Figure 3. Some of the peripheral cards and modems supported by Z-Pro.

Hayes Micromodem II
Apple Communications Card
SSM AIO board
CCS Asynchronous Serial Board
    7710A (or D)
ESI Apple Lynx system
Novation Apple Cat
MicroPeripherals Micro Connection
Hayes SmartModem (with compatible
    interface)
Mountain Computer CPS card
All display cards, provided they are
    compatible with CP/M
Mountain Computer Clock (original)
CCS 7424 Calendar Clock Module
Thunderware ThunderClock

Z-Term, The Professional is the best communications package for the CP/M Apple II that I have seen. It is user-friendly, and had me feeling like a pro in no time. ☐

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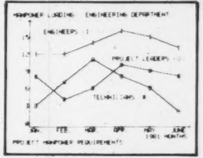
For use with Apple™ Computer Systems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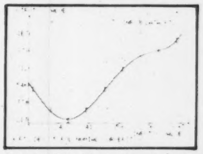
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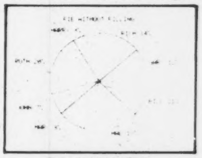
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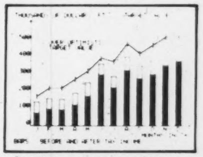
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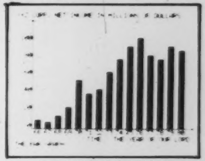
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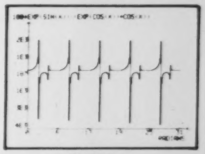
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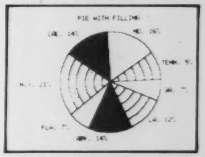
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Steven Vickers
Steven gained his degree in Math at King's College, Cambridge, England, and his Ph.D in Algebra at Leeds University. His first assignment after school was to create the Sinclair ZX-81 or Timex 1000 8K ROM, and to write the ZX-81 manual. Subsequently he wrote most of the ROM for the Sinclair Spectrum or Timex 2000.

Richard Altwasser
Richard gained his honors degree in Engineering at Trinity College, Cambridge, England. He joined Sinclair in September 1980, and was instrumental in the research that led to the development of the Spectrum or Timex 2000.

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Print a character	0.62	3.1	7.5	24
Add two numbers	0.45	5.5	7.5	28
Multiply two numbers	0.9	6.5	7.5	32

Because of the difficulty in devising exactly equivalent programs, these measurements should only be taken as a guide.

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Jupiter ACE

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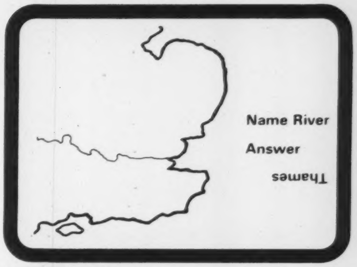
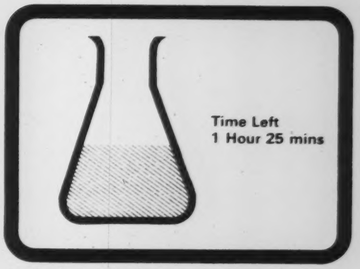
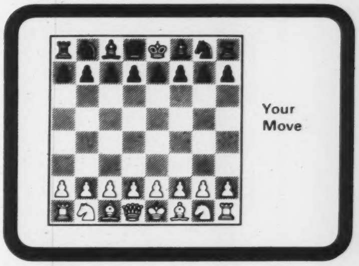


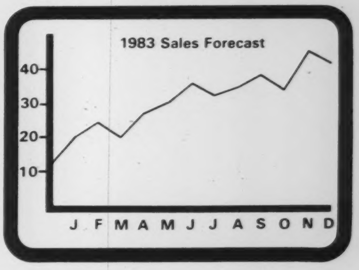
In Schools
Teachers already know how quickly children take to computing, and the Jupiter Ace is an ideal introduction. FORTH is an easy and important language to learn and by making learning fun, the Ace can help to teach science, music and many other subjects.



In Laboratories
For monitoring and controlling experiments, the Jupiter Ace has many advantages. The language is perfect, even the Jodrell Bank Radio Telescope is controlled in FORTH. The Ace expansion port enables it to be interfaced to almost anything, and the built in quartz timer allows experiments to run all weekend.



At Home
The Jupiter Ace is powerful enough to play games as complex as Chess and with sound and high resolution graphics, action games written in FORTH will stretch your reaction speeds to their limits.



In the Office
Stock control, Accounts and Financial forecasts are all possible on the Jupiter Ace. With a printer and extra memory attached you can do word processing as well.

The Jupiter Ace also features a full-size moving-key keyboard, high resolution graphics, sound, floating point arithmetic and 3K of RAM. Expandable to 51K.

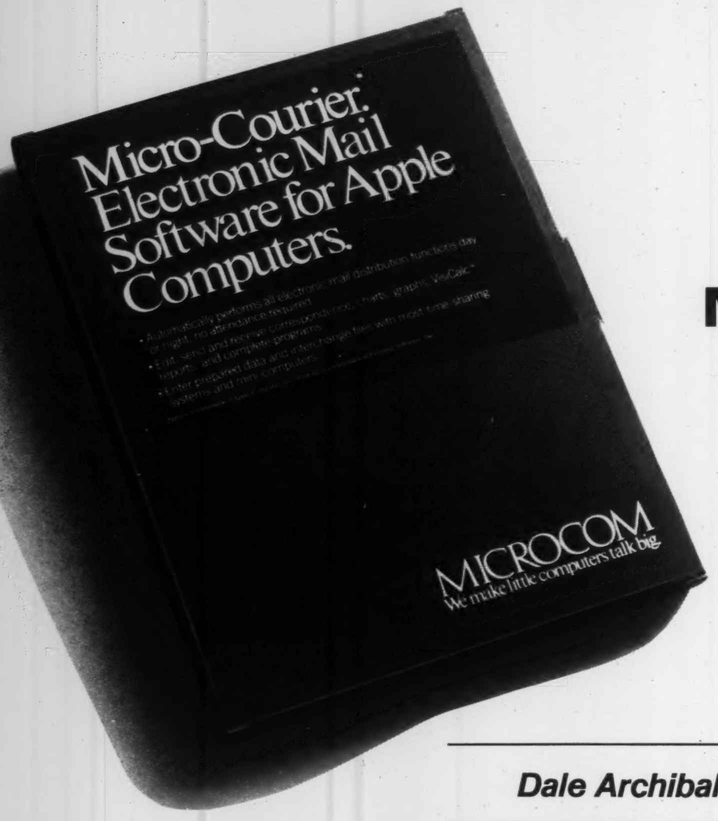
For the beginner
Which Personal Computer is best for you?
Simple! You need an easy-to-use language and a system that gives you all you need to start off with, but with room to expand. FORTH is the best language for personal computers and the Jupiter Ace is the only one designed to use it. The specification of the Ace is already impressive and with extra memory and a printer interface it can grow with you.

For the Personal Computer owner
You are already aware of the limitations of BASIC. You know how slowly your programs run and how quickly your computer's memory gets filled.
FORTH is your answer. It is easier to learn and is typically ten times faster than BASIC and it only uses 20% more memory than machine code.

For the FORTH enthusiast
The Jupiter Ace closely follows the FORTH 79 standard with extensions for floating point, sound and cassette. It has a unique and remarkable editor that allows you to list and alter words that have been previously compiled into the dictionary. This avoids the need to store screens of source, allowing the dictionary itself to be saved on cassette. Comprehensive error checking removes the worry of accidentally crashing your programs.

CIRCLE 160 ON READER SERVICE CARD

creative computing software evaluation


Micro-Courier: Electronic Mail Software for Apple Computers.
MICROCOM
We make little computers talk big

Micro-Courier

Dale Archibald

"Jones, take a letter. I want this to go to all our salespeople immediately. Hrrumph."

"Right, R.J. No problem. Go ahead."

"Dear fellows and gals. I'm happy to announce that we have had a tremendous production breakthrough. It allows us to cut the price on our model 2342 from $250 to $150, effective immediately. This price cut should increase sales immensely."

"Sign it, 'R.J. Johnson.' Hrrumph."

"It'll go out tonight, R.J."

The secretary walked down the row of offices to a door labeled Corporate Electronic Communications. Inside was an Apple II Plus, two disk drives, a Hayes Micromodem, monitor, and a printer.

He sat down and selected Create/Edit Mail from the eight-part menu on the screen. After a couple of questions from the program, he entered R.J.'s message and saved it to disk.

After hitting ESC a couple of times, he selected Address and Review Messages from the menu. Once there, he chose the list of all 47 salespeople the company had by typing Q, then entered a time of 0100 the following morning.

When that was complete, he added a few extra communications, a couple of text files, a *VisiCalc* formula, and some other odds and ends. These were addressed to the individual salespeople who had need of them.

After hitting ESC again to get to the main menu, he selected the Send/Receive Mail menu. Leaving the Apple turned on, he flipped the lights in the room off and shut the door.

A total of 100 different messages can be placed in queue for automatic transmittal.

The next morning, at 1:00, the disk drives began to whir. In offices around the country, a sequence of *Micro-Courier* programmed Apple disk drives mirrored this activity.

By 8:00 a.m., when Jones arrived to look at the message log, all salespeople had been notified of the price change; the text and other files had been transmitted; new information had arrived at the home office from the branches; and the company had saved a great deal of time and money.

This fictitious scenario is an example of how a product such as *Micro-Courier* can operate. It will send text generated by the included text editor, or any DOS 3.3 file, including programs, data, or binary files. A total of 100 different messages can be placed in queue for automatic transmittal.

Automatic service will occur only at other stations using *Micro-Courier.* However, you can also use the program as a terminal program and send text files only over the telephone lines manually.

The program was written by Microcom, located near Boston, and

creative computing
SOFTWARE PROFILE

Name: Micro-Courier

Type: Electronic mail disseminator

System: 48K Apple II with Applesoft in ROM, or II+, DOS 3.3 disk drive, D.C. Hayes Micromodem; second drive, clock card, and printer optional, but highly recommended.

Format: Disk

Language: Applesoft Basic and assembly

Summary: Valuable business utility

Price: $250

Manufacturer:
Apple Computer, Inc.
10260 Bandley Dr.
Cupertino, CA 95014

Dale Archibald, 1817 Third Ave., N., Minneapolis, MN 55405.

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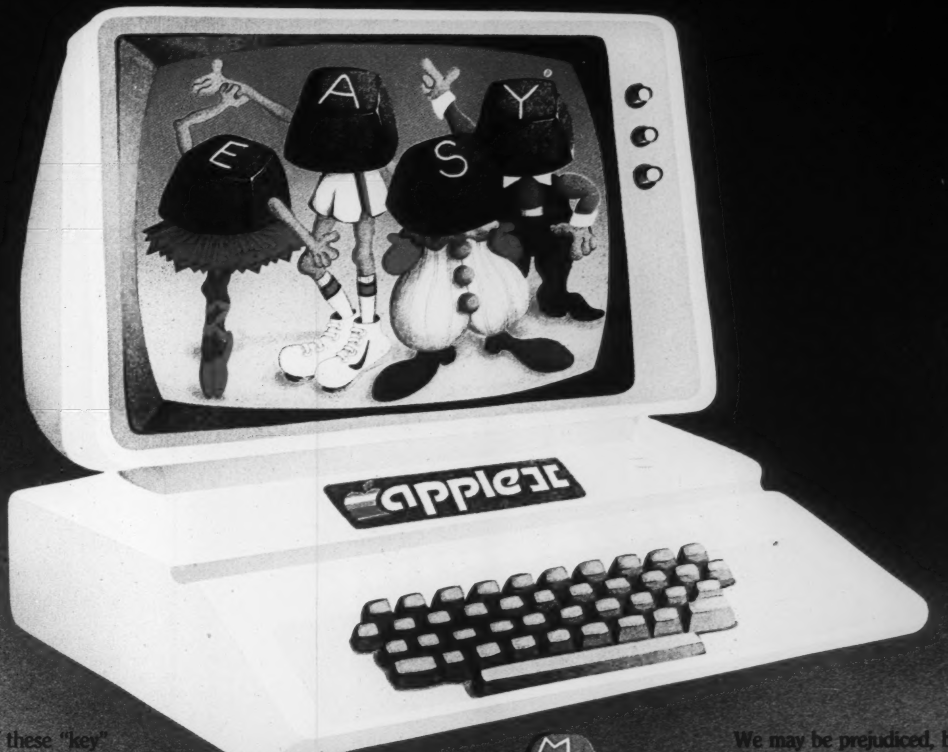

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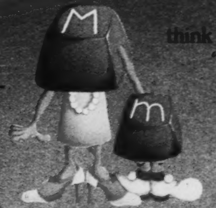

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The Enhancer II and Function Strip can be used with any Apple with a keyboard encoder board.

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CIRCLE 295 ON READER SERVICE CARD

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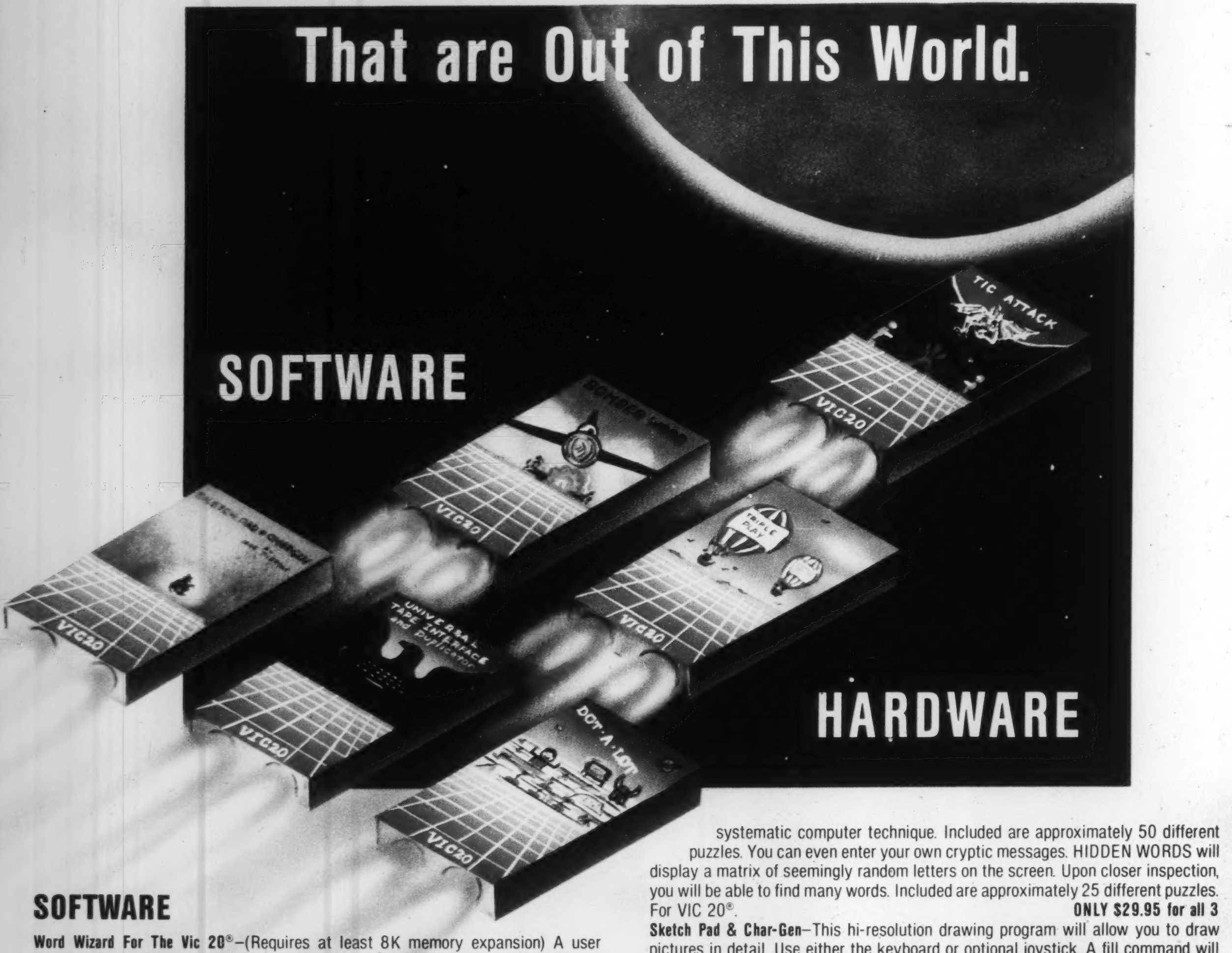
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DOT-A-LOT
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SOFTWARE

Word Wizard For The Vic 20®–(Requires at least 8K memory expansion) A user friendly WORD PROCESSOR with optional joystick control. Easy edit and string manipulation commands that follow the standard format. Full use of function keys for ease of use. 100% machine language with Delete Word, Search functions and Full Justification. Use VIC Graphic printer, or any centronics compatible printer connected to the user port. On Tape (supports disk). **$34.95.**

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CIRCLE 221 ON READER SERVICE CARD

Micro-Courier, continued...

distributed by Apple to Apple dealers and customers.

When I first received this program to examine, I was impressed by the care that had been taken with it. The 168-page instruction manual is bound exactly as the Apple manuals are.

The manual/tutorial is clear and well documented; the program prompts at every step of the way. Overall, *Micro-Courier* appears to be a good program for firms that need this type of high performance.

Naturally, a program this expensive is protected against copying. One caveat: I don't like the offer of immediate replacement upon return of the master disk; when a company needs a program like this, they need it *now.* If they had wanted to put up with delays and slow delivery, they could have continued to patronize the USPS.

After 90 days, replacements cost $35.

Using the Program

You begin by configuring the program to your system. Up to four disk drives can be accommodated, as well as the other peripherals. You also enter your printer line width, and the sender ID which will be attached to each *Micro-Courier* station.

The built-in editor is simple but complete.

You have mailbox IDs from 01 to 99 which you can assign. Select Mailbox Directory Maintenance from the menu, and the display will give you another menu. Among other things, you can then add or change mailboxes, print a directory or a list of numbers to which you regularly send electronic mail, and other things.

Once you have assigned an ID number to a recipient, you can enter his name and telephone number. Up to 36 digits can be entered here to allow for access and user codes, and pauses (an asterisk will pause for two seconds).

That's it. That's all there is to entering a mailbox ID. To send electronic mail after that just select the recipient's number.

Other Features

If you want to build a specific list (from A to Z) to which you often send a common message, select a name of up to 20 characters. The program will display the valid mailbox IDs you can add or remove.

The built-in editor is simple but complete. You can enter up to 4000 upper-case only characters with it. It will beep at the 3980 mark and at each character thereafter to warn you.

Note: I am told that this 4000 character limit applies to all files. You can transmit a longer file, but it won't be saved. If you want to send longer ones, you must break them into smaller segments and give them different file names.

Once you have saved the file under a name you have selected, you can come back and edit or change it, or print the file.

Next you have the Review/Address Outgoing Mail menu. This lets you address messages with mailbox IDs, see a log of messages ready to go or that have already been sent, and a log of messages that were sent during the last sending session. You could also remove messages, or print copies of them.

In the case of the message R.J. wanted to send to his sales force, he would have picked selection 2, Send Message to List, from the Address Messages menu.

You are asked if a file is printable. Obviously, some text files will be; other files must be interpreted by a program to have any value. It also asks if you want to use the current date and time. Thus, if you select this and go into the Send/Receive Mode, the message will be sent immediately.

If you have a clock, you will be prompted for a date and time to send. This might be helpful for "timed" announcements such as press releases, the manual points out.

You could also select Send Mail Only, Receive Only, or Send and Receive Mail. A block of four characters, two by two, mirrors what is being sent. This is visible reassurance that something is really going on inside the machine.

During a transmission, you can also stop the action with CTRL-H (Halt) or CTRL-I (Immediate Halt). Even with the precipitous effect of CTRL-I, the program will close any open files and place them into the message log.

With Review Incoming Mail from the menu, you can see and/or get a printed copy of all messages received, plus make a log of received messages, you can even review only messages addressed to a specific person at the receiving Apple.

The receiving *Micro-Courier* system adds a five-digit number from 10,000 to 99,999 to each incoming message. Thus, if two sending stations happen to use the same file name you won't be stalled, since the numbers will be different.

You can also rename a file incorrectly, using a duplicate of a name already assigned.

Micro-Courier will postpone transmissions if a message is being received while the Apple is supposed to be sending. The print-out of the Received Mail log can be used for record keeping. Thus, records that aren't printable can be tracked.

If a line is busy when the program telephones, it will go on to the next mailbox immediately and try to connect with the missed one later.

You don't need to set protocols (instructions for various machines to connect) for other *Micro-Courier* machines.

There are some weaknesses, however. The first is that the machine must redial for each message. The second is that to catalog the file names, you must go through the Utility section of the program. I could find no way to print out the file names, either.

Finally, in some segments of the program, entry of information is very limited. That is, a date must be entered as MM/DD/YY.

All things considered, *Micro-Courier* is a good program. It is easy to use, and would undoubtedly be of great value in the appropriate business situation. □

Microcom

Microcom views communications for small computers as a three-step process.

First is the simple addition of a modem, smart or dumb, and some basic software so the computer can act as a terminal. In this mode, it is able to initiate communications to a host computer, but it cannot act as a host. Some terminals use a simple protocol while others emulate more sophisticated special-purpose terminals (Telex, 3240, etc.).

Second is communications in which the small computer can act as a host to either a smart or dumb terminal or another computer. *Micro-Courier* is an example of this type of system. The computer can then be used for point-to-point electronic mail, local bulletin boards and data bases, and downloading of programs. An advanced version of *Micro-Courier* can support several different protocols so that, for example, a Basic program can be transmitted from a TRS-80 Model III to an Apple II (it won't necessarily run once it gets there, however).

The third step is a specific applications software package overlaid on the basic communications software. This could simulate a Telegraph or TWX and could operate completely unattended for both receiving and sending. *Micro Telegraph* is such a product.

VisiCalc Made Easier

L. L. Beavers

creative computing
SOFTWARE PROFILE

Name: Cdex Training for Visicalc
Type: Computer-assisted training for Visicalc
System: 48K Apple II Plus, disk drive
Format: Three 16-sector disks
Summary: Well-designed training program in Visicalc fundamentals
Price: $49.95
Manufacturer:
Cdex Corporation
5050 El Camino Real
Suite 200
Los Altos, CA 94022

I once plopped a coworker down in front of an Apple, handed her the *Visicalc* manual, and said something like, "Here, learn this—it's easy." I lied a little. As good as the *Visicalc* tutorial is, it is really not that easy. But with *Cdex*, learning *Visicalc* on your own is definitely made easier. *Cdex* won't teach you advanced *Visicalc* techniques, but it should take you from Visi-innocent to competent user in a few hours.

Not Like a Book

The *Cdex* program comes on three diskettes, each of which presents a series of brief lessons. You need not take them in the recommended order, but the progression appears carefully planned, so you probably should. Also encased in the *Cdex* box is a small three-ring binder containing a 62-page manual. The manual is organized into three tabbed sections: *Visicalc* command reference, examples of seven *Visicalc* worksheets, and exercises.

Using *Cdex* is not like working through the *Visicalc* tutorial. This program is much more than a book displayed one monitor screen at a time. Text, graphics, and sound are all used—and used well.

The type font used in the text displays is large, easy to read, and pleasant to look at. The displays were designed by someone who understood how to use layout to communicate. There are no gaudy flashing or inverse characters to detract from the readability of the display, but the important points are clear at a glance.

The graphics are equally well done. The graphic displays are of two basic types. One is a very nice picture of the Apple keyboard (with a couple of characters missing—more about that later), to help you find the keys important to *Visicalc*. The other is a slightly shrunken image of the *Visicalc* display screen. This enables *Cdex* to show you what happens on the *Visicalc* screen when you type a command. What you see unfold on these displays is very close to what you will see when you try the same commands with *Visicalc*. The main difference is that events are slowed on the *Cdex* displays to give you time to see what is happening. The text accompanying these graphics points out what to look for, sometimes with the help of flashing arrows pointing to a particularly important part of the display.

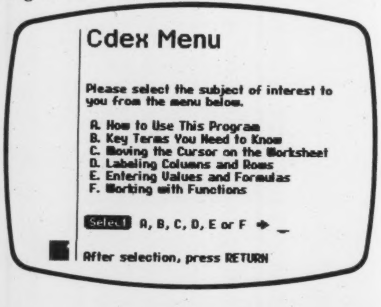
Cdex uses sound most effectively to alert you to watch the screen for some important event—just before the *Visicalc* graphic is to change, for example. Sound is also used to reward right answers to questions (happy beeps—TERRIFIC!), and to alert you to errors (not-so-happy beeps—NOT QUITE). The sounds used are not overly intrusive, though some may find the happy beeps a bit heavy handed.

Text, graphics, and sound are not only well handled individually, but they are well integrated. When something is about to happen on the *Visicalc* facsimile, text appears alerting you to what is about to happen. Then you press RETURN or type a command, you hear a beep, and you see the event take place on the same screen. Then more text may be added for emphasis. All of this is usually done without the discontinuity and annoying delay of erasing and reprinting the screen.

Using Cdex

A *Cdex* session begins with two title screens, the second of which asks for your name, followed by a main menu. I have reproduced the menus for the three diskettes as Figures 1, 2, and 3. Each menu item is a lesson on a particular *Visicalc* topic.

Figure 1.



Cdex Menu

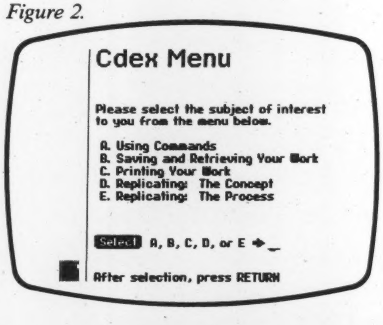
Please select the subject of interest to you from the menu below.

A. How to Use This Program
B. Key Terms You Need to Know
C. Moving the Cursor on the Worksheet
D. Labeling Columns and Rows
E. Entering Values and Formulas
F. Working with Functions

Select A, B, C, D, E or F ➜ _

After selection, press RETURN

Figure 2.



Cdex Menu

Please select the subject of interest to you from the menu below.

A. Using Commands
B. Saving and Retrieving Your Work
C. Printing Your Work
D. Replicating: The Concept
E. Replicating: The Process

Select A, B, C, D, or E ➜ _

After selection, press RETURN

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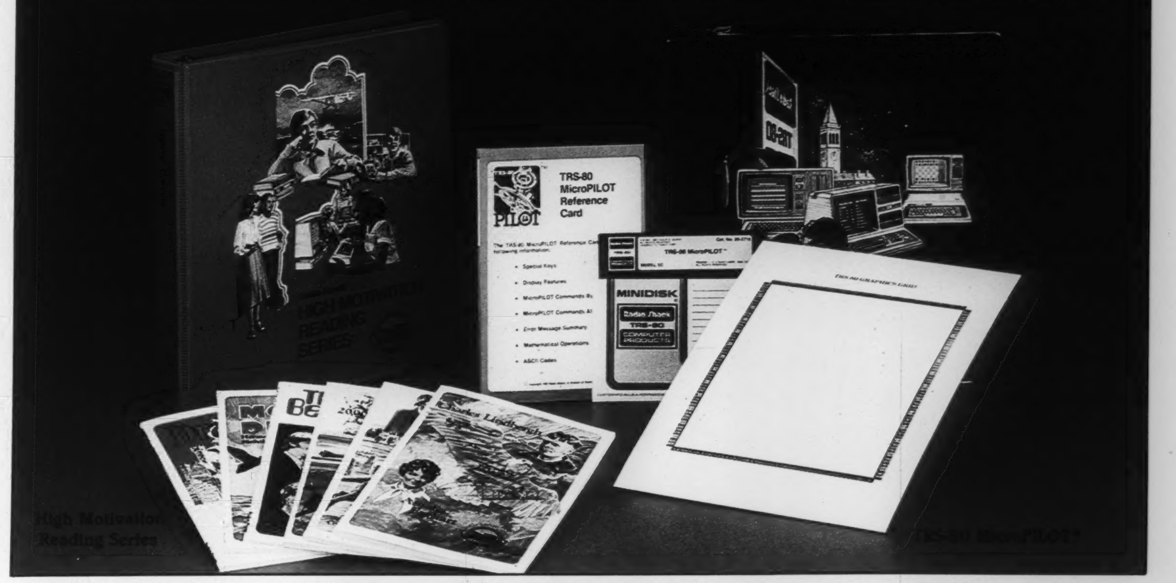
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HMRS Moby Dick	26-2516	69.95	**41.97**
HMRS The Beatles	26-2517	69.95	**41.97**
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HMRS Student Records System	26-2521	29.95	**17.97**
TRS-80 MicroPILOT	26-2718	119.95	**71.97**

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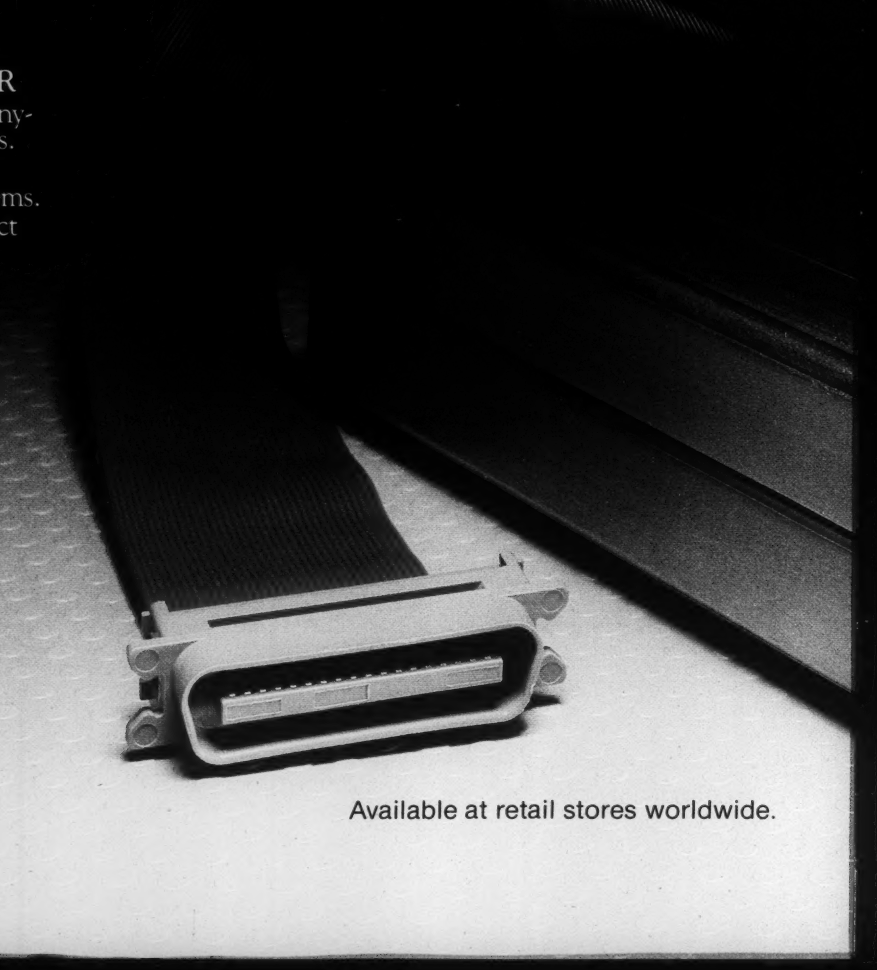

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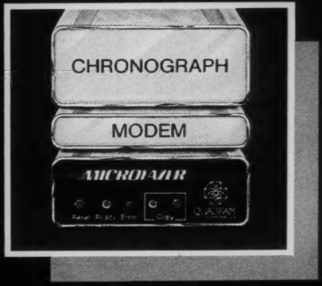
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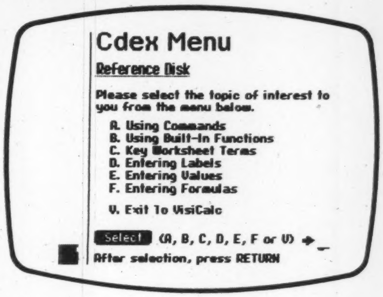
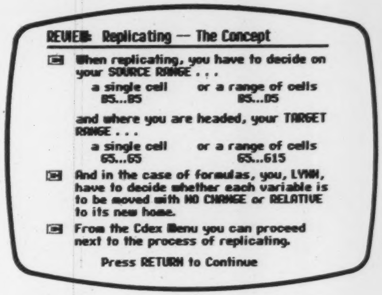


```
Cdex Menu
Reference Disk

Please select the topic of interest to
you from the menu below.

  A. Using Commands
  B. Using Built-In Functions
  C. Key Worksheet Terms
  D. Entering Labels
  E. Entering Values
  F. Entering Formulas

  V. Exit To VisiCalc

Select (A, B, C, D, E, F or V) ➔ _
After selection, press RETURN
```

Figure 3.



```
REVIEW: Replicating — The Concept
▣ When replicating, you have to decide on
  your SOURCE RANGE . . .
     a single cell      or a range of cells
       B5...B5                 B5...D5
  and where you are headed, your TARGET
  RANGE . . .
     a single cell      or a range of cells
       G5...G5                 G5...G15
▣ And in the case of formulas, you, LYNN,
  have to decide whether each variable is
  to be moved with NO CHANGE or RELATIVE
  to its new home.
▣ From the Cdex Menu you can proceed
  next to the process of replicating.

      Press RETURN to Continue
```

Figure 4.

Lessons generally begin with a brief review of relevant prior material, continue with a series of instructional screens, and end with a test question and suggested exercises. Throughout this process, user input seems to be extremely well error-trapped. Pressing RESET causes the disk to re-boot, but I couldn't cause the program to end abnormally in any other way. Generally, responses not in the set of possibilities are ignored and do not appear on the screen.

Instruction Screens

The series of instruction screens presented for each menu topic contains the real substance of the lessons. I found them generally to be clearly and concisely written, well paced, and accurate in their representation of the behavior of *Visicalc.*

For instance, the replicate command (/R) is probably the most conceptually difficult of the basic *Visicalc* commands. *Cdex* handles it in two lessons, one devoted to the concept and the other to the procedure. Take a look at Figure 4, which shows a review screen from the "Replicating—The Concept" lesson.

That's a nice, lucid review of the idea. It follows a series of other nice, lucid explanations, which together communicate very well the power and use of the replicate command.

Of course, there are a few places in the *Cdex* training program in which I think that the explanations are unclear or contain errors. I have compiled the ones I found in a "Quibble List" contained in the sidebar. Those evaluating *Cdex* for purchase should find it easy to scan this list and form their own opinions of the seriousness of the problems. Those using the programs should find some useful clarification in the list. In my opinion the quibbles listed don't significantly impair the usefulness of the program.

Quiz Time

After *Cdex* presents the instruction screens, it asks one test question. Since each lesson covers a relatively small subject, and since the instruction screens often include some question-and-answer interaction, one question seems to be enough.

The question screen offers options other than the obvious one of entering the answer. You can ask for a hint, you can review the material in the lesson, or you can skip the question entirely. The hints seem to offer a good compromise between giving too much information and giving no help at all. The review option simply restarts the series of instruction screens over again. This review process can be frustratingly slow if all you are looking for is one item of information.

The best feature of the quiz routine is its error diagnosis.

I think that the best feature of the quiz routine is its error diagnosis. Errors that show inadequate understanding of some part of the lesson are greeted with a message clarifying that point. For example, in *Visicalc* if you want a cell to have the same value as that in cell B5, you must type +B5 to specify the value reference. If you omit the + and simply type B5, *Visicalc* treats it as a label (which has a zero numeric value) because the first character typed was alphabetic. When *Cdex* asked me a question about this, I intentionally omitted the plus sign. The program told me that I had forgotten it, reminded me of why it was important, and invited me to try again. Very nice.

Visicalc Exercise

At the very end of each lesson is a screen directing you to the *Cdex* manual for a guided practice session with *Visicalc.* You can skip this exercise, but I suggest that you take advantage of it. There is nothing like hands-on experience to show you what you don't know. The exercises are short, and worth the time.

Cdex and the Visi-Innocent

I have used *Visicalc* extensively, so I am hardly a typical customer for the *Cdex* program; but my wife is. As a lending officer for a major bank, she does a great deal of financial analysis. *Visicalc* is well-suited for that kind of work, but she has never had a chance to learn it.

Predictably, her reactions to *Cdex* were a little different from mine. First there were matters of taste. *Cdex* starts each session by asking your name. My wife felt this a bit childish, so she gave it a scatological response. I recommend that everyone try this at least once—some of the resulting *Cdex* messages are hilarious. She also felt that the use of sound to indicate right answers was "dumb." "'Correct' would be sufficient," she said.

She found the delay in drawing graphic displays sometimes annoying, but agreed that the graphics were well done and informative. She also pointed out some ambiguities that I had overlooked. They appear in the Quibble List.

She liked the organization of the program in small segments, pointing out that people using it in an office environment would be subject to interruptions. But this makes the ability to review the instruction screens rapidly even more desirable, and its absence more irritating.

Overall she thought *Cdex* a "good program." More to the point, she was able to acquire a practical working knowledge of *Visicalc* in about six hours. These hours were not in a single block, but were scattered over a one-week period, just as they probably would be in an office environment.

Summary

I agree with her evaluation—*Cdex* is a good program, and a very good value for its $49.95 price. It should be very useful to those who need to learn the fundamentals of *Visicalc.* Having someone available to answer questions might be useful, but I think *Cdex* is easily good enough to stand alone if necessary.

Cdex is not (and does not claim to be) a substitute for reading and understanding the *Visicalc* manual. I suggest a careful reading of Part III (Visicalc Command Reference) of the *Visicalc* manual after completing the *Cdex* course. You will not then be a sophisticated *Visicalc* user—that only comes with experience—but you will have a solid foundation on which to build sophistication.

Quibble List

Below are some quibbles I have with the *Cdex* program. These quibbles fall into two broad categories: misleading or inaccurate statements regarding *Visicalc*, and unclear or ambiguous instructions. I have organized these in a rough order from most to least serious. I don't think that any of these problems, or even all of them taken together, is serious enough to significantly damage the usefulness of *Cdex* as a training tool—which is why I call them "quibbles."

Inaccuracies

Graph Format (/F*)
Cdex says that *Visicalc* rounds decimal numbers to integer values to determine the number of asterisks plotted. Actually the program *truncates* (*Visicalc* manual, p. 3-20).

Formula Calculation
The conventional way of resolving formulas uses a "hierarchy of operations"—multiplication and division operations are performed first, then addition and subtraction operations. For example, in Basic the statement PRINT 2+4/2 would give 4. *Visicalc* doesn't work that way. It resolves formulas from left to right, so that the formula 2+4/2 would give a *Visicalc* result of 3. Many *Visicalc* users expect the hierarchy of operations to be obeyed. *Cdex* should have alerted them that *Visicalc* behaves more like a hand calculator than a computer program in this respect. Worse, *Cdex* does not mention the function of parentheses in grouping terms (see pp. 2-69 to 2-70 and 3-72 in the *Visicalc* manual). I consider this important enough to label it an inaccuracy—by omission.

Overlaying
According to *Cdex,* when you are loading a file from your storage disk (/SL), the *Visicalc* screen must be clear. Actually, *Visicalc* has no such requirement, and if you adhere to it you will lose what overlaying capabilities *Visicalc* has (see pp. 3-60 to 3-61 of the *Visicalc* manual).

Keyboard Graphic
The *Cdex* graphic display of the Apple keyboard does not show two of the characters needed for *Visicalc* applications. One is the circumflex (^), which *Visicalc* uses to indicate exponentiation, and which is typed as SHIFT-N. The other is the @, which *Visicalc* uses as the first character of all function references, and which is typed as SHIFT-P.

Ambiguities

File Deletion (/SD)
In its discussion of the command to delete a file on the *Visicalc* storage disk, *Cdex* says that after the command is completed you can change your mind and resave the sheet with /SS. That is true *if* the sheet on the screen is the same as the file that was deleted. *Visicalc* will let you delete any file on the disk, and if the one you delete is not the one on the screen, the deletion is final.

Cell As Third Dimension
Cdex discusses a cell on the *Visicalc* worksheet as having "depth" and as giving *Visicalc* a "third dimension." I think this obscures a simple idea: a cell is just a place on the worksheet into which you can write a label, a number, or a formula.

Forward Reference
Cdex has only a rather oblique reference to a common *Visicalc* problem, "If you reference a cell that *Visicalc* has not yet calculated, an error may occur." This is called a "forward reference" in the *Visicalc* manual (pp. 2-63 to 2-64), and it is an important source of error—especially for inexperienced users. *Cdex* also mentions the *Visicalc* commands to change the order of recalculation (/GOR and /GOC), without telling you why you would want to do such a thing. Avoiding forward reference is the reason (see pp. 3-22 through 3-25 of the *Visicalc* manual).

Printing (/P)
Printing a worksheet is one of the more complicated *Visicalc* functions, primarily because of the differences among printer configurations. One of the *Cdex* screens says that a setup string is used for producing special effects on the printer. Since those "special effects" include printing anything more than 40 characters on a line, the setup string may be essential to effective use of your printer. The *Cdex* manual notes this possibility (p. 12) and refers you to the *Visicalc* manual for details (I suggest pp. 3-40 to 3-48). If you read that section of the *Visicalc* manual, you may also notice that the *Cdex* discussion of the /PP option is not entirely correct. *Cdex* says that you must specify the slot number of the printer interface if it is any slot other than 1. According to the *Visicalc* manual, /PP causes *Visicalc* to output to the lowest numbered slot containing a peripheral communications card—not necessarily slot 1. You would have a problem typing /PP if you had an inactive peripheral on a lower-numbered slot than the one the printer interface is in, so you are better off to develop the habit of typing the printer slot number rather than /PP.

Visicalc Functions
The way the *Visicalc* functions are categorized on *Cdex* Disk 3 is not particularly clean. One of the categories is "List Functions," which is said to include @SUM, @MAX, @MIN, @COUNT, and @AVERAGE. From the name of this category and the functions in it, you might conclude that these are the functions that accept lists of *Visicalc* cells as arguments. But some of the logical functions do too (@AND and @OR), as does @CHOOSE. Also, while we're on the subject of functions, *Cdex* says that the result of the @MAX function is the "identity of the largest value." Actually, *Visicalc* just returns the largest value. What's the "identity of" 4?

Exercises
On *Cdex* Disks 1 and 2, the final screen of each lesson directs you to an exercise outlined in the *Cdex* manual. The directions presented on that final screen are out of order. Item 2 tells you to read and follow the printed exercise. But the printed exercise begins with the statement, "A blank *Visicalc* worksheet should now be showing on your screen." Item 3 on the *Cdex* display screen tells you how to boot the *Visicalc* disk, and so produce that blank worksheet. The printed instructions preceding the series of exercises in the *Cdex* manual also tell you how to boot *Visicalc,* but some users might still find the sequence on the display screen confusing. □

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CIRCLE 105 ON READER SERVICE CARD

creative computing software evaluation

A Picture Is Worth 1,000 Words But How Many Numbers?

L. L. Beavers

I like numbers. That makes me a little strange, because most people don't. In a sense, they're right: numbers don't communicate. Consider Ms. Big.

A Session with Apple II Business Graphics

As an executive with Chewie Gobbles Confections, Inc., you have been asked to design a presentation for Ms. Big, executive vice president of your parent company, International Munchies. Ms. Big is your basic bottom-line sort of person—she wants specifics, she wants to see them clearly and quickly, and she wants to know what they mean to her. You are supposed to turn some sales and margin numbers into a presentation that will make her smile. You have one hour.

First, feed the computer. You put the *Apple II Business Graphics* disk into drive 1 and a data disk you have named CHEWIE: into drive 2, and turn on the power. After some whirring of disks, and some noises that sound like the program disk is being initialized (one of Apple's technical support people assures me this is normal), you get a prompt.

You type EDIT to invoke the editor, and after a few seconds the number one and a question mark appear on the screen. You want time on the horizontal axis, so you enter the sales figure this way:

```
1:    ? "1977",1.06
2:    ? 1978,1.40
3:    ? 1979,1.80
4:    ? 1980,2.27
5:    ? 1981,2.71
6:    ? END
```

The word END exits the editor, and the computer responds with:

```
5 LABELS LOADED
5 POINTS LOADED
```

You save the data with the command SAVE CHEWIE:SALES. Now you type CLEAR to clear the work file and EDIT to reinvoke the editor, and you enter your gross margin figures:

```
1:    ? "1977",41
2:    ? 1978,37
3:    ? 1979,38
4:    ? 1980,38
5:    ? 1981,40
6:    ? END
```

You save these data on your CHEWIE disk with the command SAVE CHEWIE:MARGINS.

The computer now has all of your data.

creative computing
SOFTWARE PROFILE

Name: Apple II Business Graphics
Type: Interactive business graphics package
System: 48K Apple II, at least two disk drives, language card or 16K add-on memory card.
Format: Disk
Language: Pascal
Summary: Excellent general purpose business graphics package
Developed By: Business & Professional Software, Inc.
Cambridge, MA
Distributed By:
Apple Computer, Inc.
10260 Bandley Dr.
Cupertino, CA 95014

L. L. Beavers, 23005 Ash Glen Circle, Valencia, CA 91355.

Business Graphics, continued...

Elapsed time: 5 minutes. You decide to look at the sales data first, so you type:

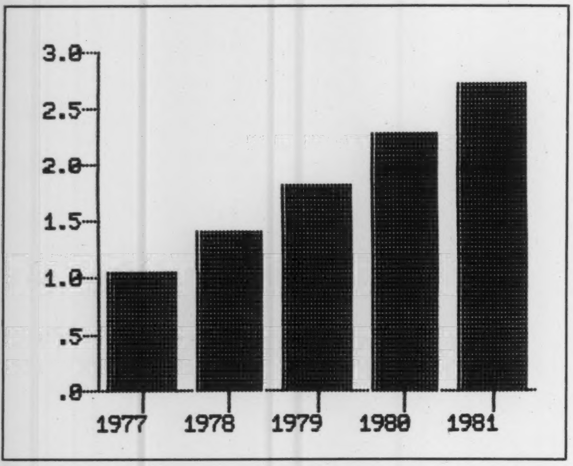
```
CLEAR
LOAD CHEWIE:SALES
```

The program responds with:

```
5 LABELS LOADED
5 POINTS LOADED
```

How about a bar graph? You type DRAW BAR, and the following graph appears on your screen.

Graph 1.



Now for some titles:

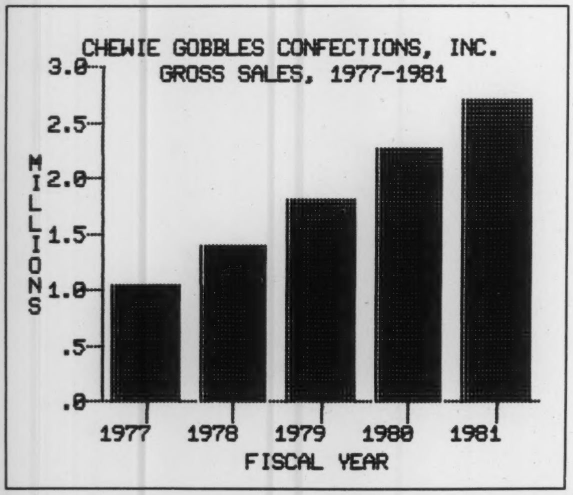
```
SET TITLE "CHEWIE GOBBLES CONFECTIONS, INC."
SET HORIZONTAL TITLE "FISCAL YEAR"
SET VERTICAL TITLE "MILLIONS"
```

The title should be more specific, so:

```
SET FLOATING TITLE "GROSS SALES, 1977-1981"
```

A box appears on the graphics screen, and you use the U (up), D (down), L (left), and R (right) keys to position the title under the title of the graph. The results look like this:

Graph 2.



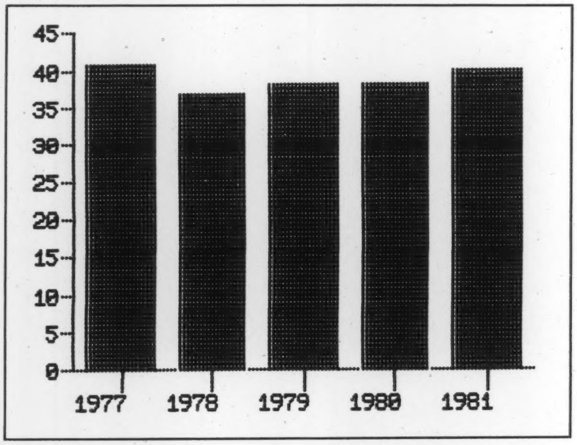
That looks fine. You save this display by typing SAVE SCREEN CHEWIE:SALES. Elapsed time: 11 minutes.

Now for the margin figures:

```
CLEAR
LOAD CHEWIE:MARGINS
SET VERTICAL RANGE 0 45
DRAW BAR
```

What you get looks like this:

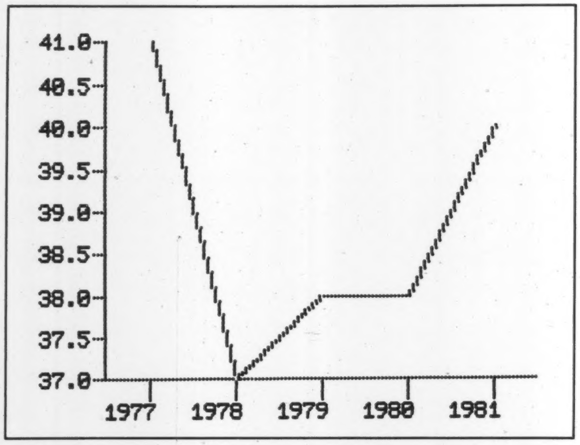
Graph 3.



Not so good. The fluctuations in the margin figures get lost among the trees. Maybe a line graph would be better.

```
CLEAR SCREEN
CLEAR VERTICAL RANGE
DRAW LINE
```

Graph 4.



Now we can see what's happening, and it isn't all good. Ms. Big should be told what happened in 1978:

```
SET FLOATING TITLE "1978 SUGAR UP 60%"
```

You position that title, and type in the remaining titles:

```
SET TITLE "CHEWIE GOBBLES CONFECTIONS, INC."
SET VERTICAL TITLE "% OF SALES"
SET HORIZONTAL TITLE "FISCAL YEAR"
SET FLOATING TITLE "GROSS MARGINS, 1977-1981"
```

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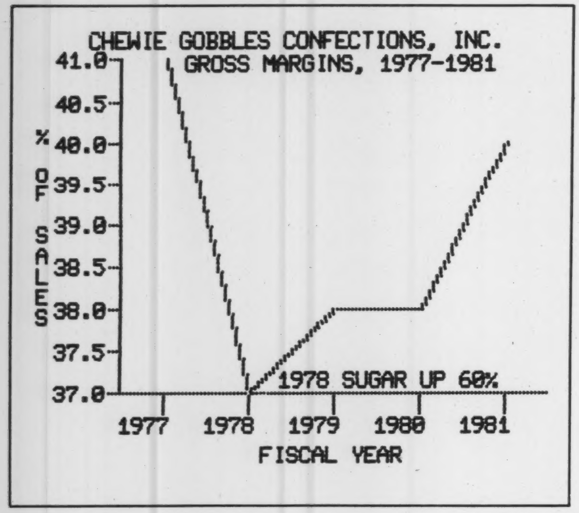
CIRCLE 178 ON READER SERVICE CARD

The result of your efforts looks like this:

Graph 5.



You save the graph by typing, SAVE SCREEN CHEWIE:MARGINS.

You are now ready to print the results for your boss's approval. Total elapsed time: 20 minutes. Have a cup of coffee.

Which Graphs You Need

The man who wrote of office buildings, "Form ever follows function," could have been talking about graphics. In graphics "function" means communication: communication between you and your data (interpretation), and communication between you and other people (presentation).

For both interpretation and presentation, you need three kinds of graphs: line graphs, bar graphs, and pie charts.

When you have few numbers and large differences between them, try a bar graph.

Line Graphs

You need line graphs to depict trends, and *Apple II Business Graphics* offers extensive line graph capabilities.

First, you want to be able to plot as many points as you need on a single curve. With *Apple II Business Graphics* the number of points is limited more by practicality than by the program. I have plotted as many as 400 points on one curve.

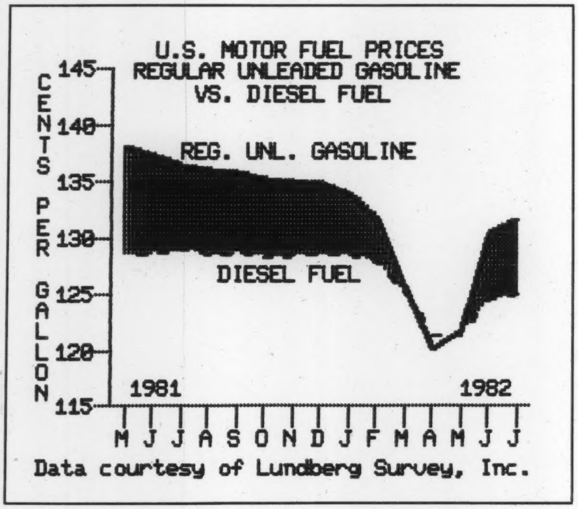
Second, you want to compare curves by plotting them on the same graph. Of course, the curves must be distinguishable. *Apple II Business Graphics* provides two methods: eight different symbols for the plot points and six different curve types. Here, too, practicality is the limit: you could plot 15 distinguishable curves, but no one would read them.

Third, you want control of the ranges of the numeric scales. The scale can have a tremendous effect on what a graph appears to say. Plot on a large scale and fluctuations and trends will look small; plot on a small scale and they will look large. *Apple II Business Graphics* lets you choose a scale that accurately represents your data.

Apple II Business Graphics offers one more option useful with line graphs. You can color in the area between a curve connecting your data points and the horizontal axis. This is called "shading."

One common use of shading is to emphasize the difference between two sets of numbers. Suppose I am interested in the prices of unleaded gasoline and of diesel fuel, and in the difference between them. Then I might use this graph:

Graph 6.



Data courtesy of Lundberg Survey, Inc.

Unfortunately, there is no command for filling in the area between curves. I did the display by first filling the area under the unleaded gasoline price curve. Then I filled the area under the diesel price curve with the color set to black, thus erasing that shading. The remaining shaded area is between the two curves. I then drew the two curves and drew a horizontal line at 115 (since the horizontal axis had been partially erased).

Those are the most important line graphing capabilities, and they are all available—though perhaps requiring a little fudging. But you don't want to draw lines for the rest of your life do you?

Bar Graphs

When you have few numbers and large differences between them, try a bar graph. Bar graphs are properly drawn from a zero baseline, so small differences get lost. That's why we rejected the bar graph of gross margins for Ms. Big.

As with line graphs, the ability to plot more than one set of numbers on the same bar chart is useful. *Apple II Business Graphics* limits you to four data sets per graph. If both scales are numeric, you can use overlapping bars and plot more data sets, but the need rarely arises.

The bars can be vertical or horizontal. They can be filled, outlined, or both. Furthermore the filling or outlining can be done in your choice of colors (green, violet, white, orange, blue, or black). Even with a black-and-white display, colors can be used to vary the density of lines and shading.

You don't have control over the width of the bars. Rejoice. You don't want it. The program scales the width based on the

october fest

MENU (disk directory)

educational section
  tourist map - historical facts
  gourmet guide - german vocabulary
game section
  beer drinkers contest
  haunted house - play old organ
quiz
  quiz training - form

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CIRCLE 115 ON READER SERVICE CARD

Inside Apple

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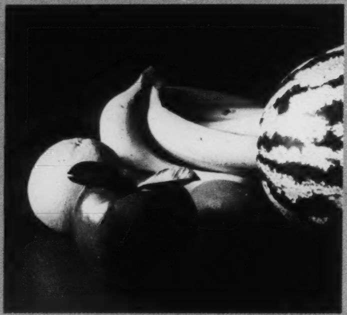


There are more people in more places making more accessories and peripherals for Apples than for any other personal computer in the world.

Thanks to those people — in hundreds of independent companies — you can make the humblest 1978 Apple II turn tricks that are still on IBM's Wish List for 1984.

But now we're coming out with our very own line of peripherals and accessories for Apple® Personal Computers.

For two very good reasons.

First, compatibility. We've created a totally kluge-free family of products designed to take full advantage of all the advantages built into every Apple.

Second, service and support. Now the same kindly dealer who keeps your Apple PC in the pink can do the same competent job for your Apple hard-disk and your Apple daisywheel printer.

So if you're looking to expand the capabilities of your Apple II or III, remember:

Now you can add Apples to Apples.

A joy to behold.

The new Apple Joystick II is the ultimate hand control device for the Apple II.

Why is it such a joy to use?

With two firing buttons, it's the first ambidextrous joystick — just as comfortable for lefties as righties.

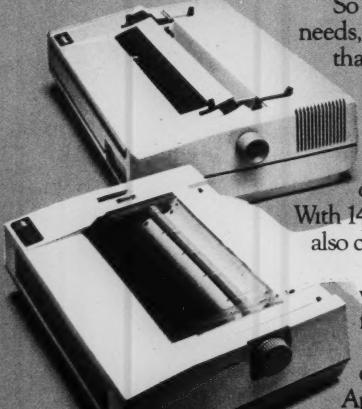
Of course, it gives you 360° cursor control (not just 8-way like some game-oriented devices) and full X/Y coordinate control.

And the Joystick II contains high-quality components and switches tested to over 1,000,000 life cycles.

Which makes it a thing of beauty. And a joystick forever.

Gutenberg would be proud.

Old Faithful Silentype® has now been joined by New Faithfuls, the Apple Dot Matrix Printer and the Apple Letter Quality Printer.

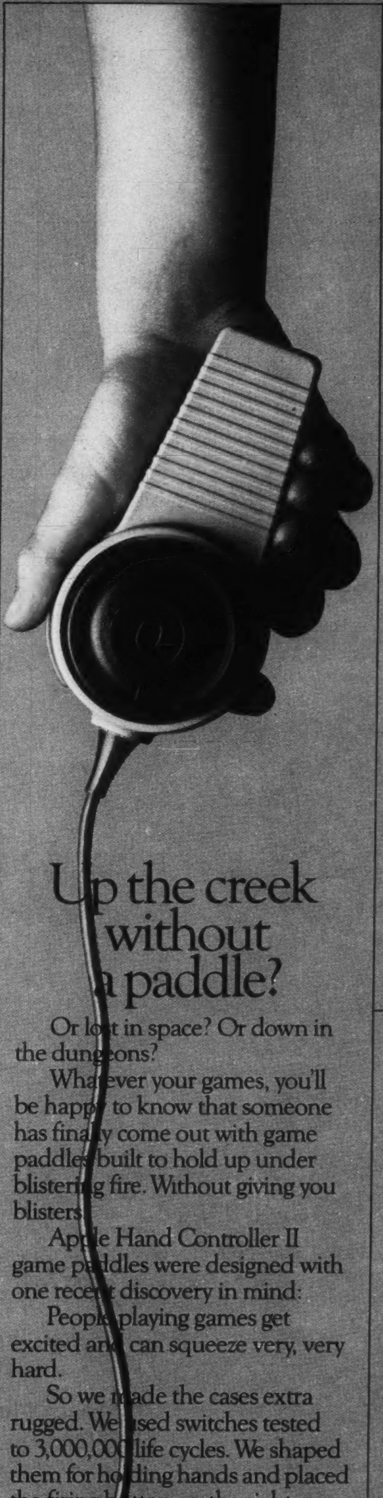


So now, whatever your budget and your needs, you can hook your Apple to a printer that's specifically designed to take advantage of all the features built into your Apple. With no compromises.

The 7x9 Apple Dot Matrix Printer is redefining "correspondence quality" with exceptional legibility. With 144x160 dots per square inch, it can also create high resolution graphics.

The Apple Letter Quality Printer, which gets the words out about 33% faster than other daisywheel printers in its price range, also offers graphics capabilities. See your authorized Apple dealer for more information and demonstrations. Because, unfortunately, all the news fit to print simply doesn't fit.

©1983 Apple Computer Inc.



Up the creek without a paddle?

Or lost in space? Or down in the dungeons?

Whatever your games, you'll be happy to know that someone has finally come out with game paddles built to hold up under blistering fire. Without giving you blisters.

Apple Hand Controller II game paddles were designed with one recent discovery in mind:

People playing games get excited and can squeeze very, very hard.

So we made the cases extra rugged. We used switches tested to 3,000,000 life cycles. We shaped them for holding hands and placed the firing button on the right rear side for maximum comfort.

So you'll never miss a shot.

A storehouse of knowledge.

If you work with so much data or so many programs that you find yourself shuffling diskettes constantly, you should take a look at Apple's ProFile,™ the personal mass storage system for the Apple III Personal Computer.

This Winchester-based 5-megabyte hard disk can handle as much data as 35 floppies. Even more important for some, it can access that data about 10-times faster than a standard floppy drive.

So now your Apple III can handle jobs once reserved for computers costing thousands more.

As for quality and reliability, you need only store one word of wisdom:

Apple.

monitor ///
apple ///

Launching pad for numeric data.

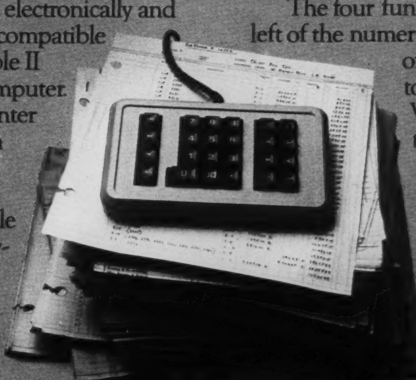
Good tidings for crunchers of numerous numbers:

Apple now offers a numeric keypad that's electronically and aesthetically compatible with the Apple II Personal Computer. So you can enter numeric data faster than ever before.

The Apple Numeric Keypad II has a standard calculator-style layout. Appropriate, because unlike some other keypads, it can actually function as a calculator.

The four function keys to the left of the numeric pad should be of special interest to people who use VisiCalc.® Because they let you zip around your work sheet more easily than ever, adding and deleting entries.

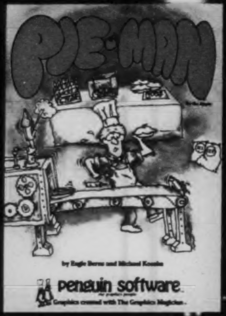
With one hand tied behind your back.



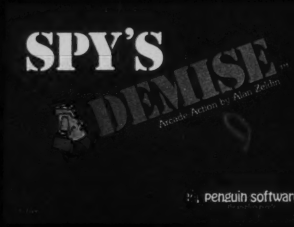
CIRCLE 112 ON READER SERVICE CARD

VisiCalc is a registered trademark of VisiCorp. Inc.

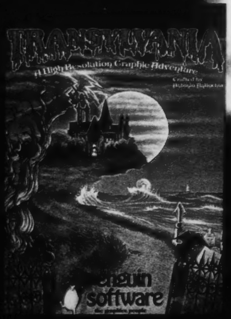
LOOK WHAT YOU CAN GET FOR $19.95!


PIE-MAN
by Eagle Berns and Michael Kosaka
penguin software
Graphics created with The Graphics Magician

Chaos in the bakery as you contend with a cantankerous conveyor belt in an effort to make pies.


SPY'S
DEMISE
Arcade Action by Alan Zeldin
penguin software

See if you can sneak past the security guards in this best-seller.

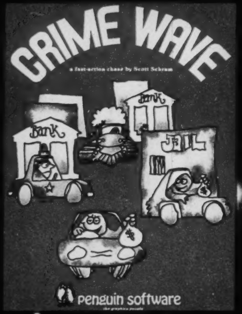

TRANSYLVANIA
A High-Resolution Graphic Adventure
penguin software

"Best graphics ever in a hi-res adventure ..."
—Softalk

NEW RELEASES

THUNDERBOMBS
Fast Arcade Action by Thomas Becklund
penguin software

Run a gauntlet of deadly alien sharpshooters.


CRIME WAVE
a fast-action chase by Scott Schram
Bank
Bank
JAIL
penguin software

The criminal element has run amok. Can you round them up?

We believe games should be fun and that the price of games shouldn't dampen that fun. The growth of the market over the past couple of years leads us to believe that $19.95 may work now as a reasonable game price, so we're trying it for the next six months, and if we're right, longer. This policy does not just apply to new games, but to ALL our games, including our past and current best-sellers! Our bet is that we'll sell more and that the increased sales will offset the decreased income per product. If so, more people get to play our games, and we still make enough to keep developing newer and better software.

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penguin software *the graphics people*

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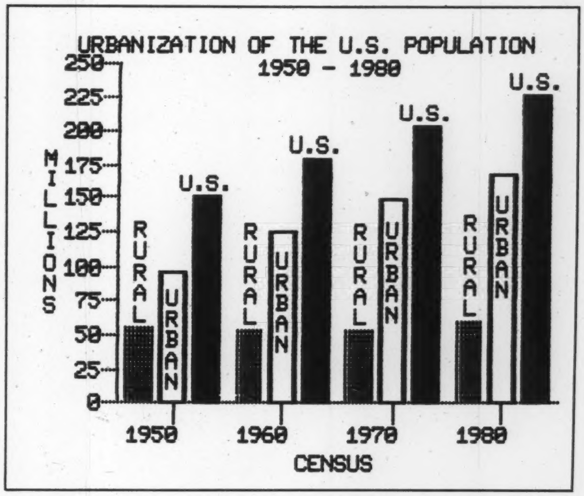
Business Graphics, continued...

number of bars being drawn. Practical applications for variable width bars are rare, and doing the scaling yourself can be a major nuisance.

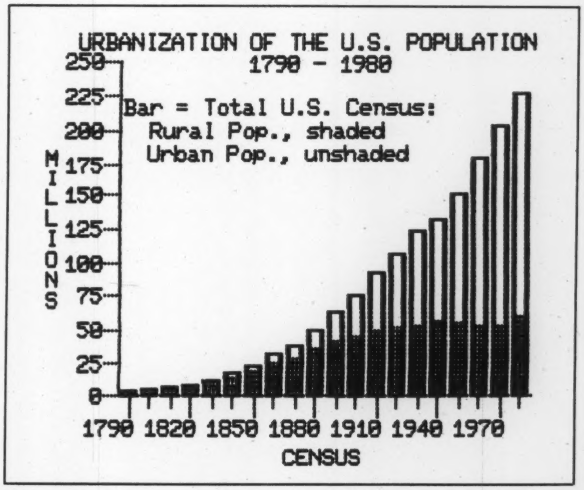
Also not available is one option you might want—segmented bars. The need for this kind of display is fairly common. It arises when you have a set of numbers that you want to show in a bar graph, but each number has two or more components that you also want to show. For example, suppose you are interested in the growth of the U.S. population, but you also want to see the urbanization of that population. You could represent the total population, the urban population, and the rural population as three data sets on a multiple bar graph, like this:

Graph 7.



The problem with this is that the reader can't see that the total is the sum of the urban and rural populations. Until the reader knows this, the increasing proportion of the population living in cities is obscure. A much better display would be the following:

Graph 8.

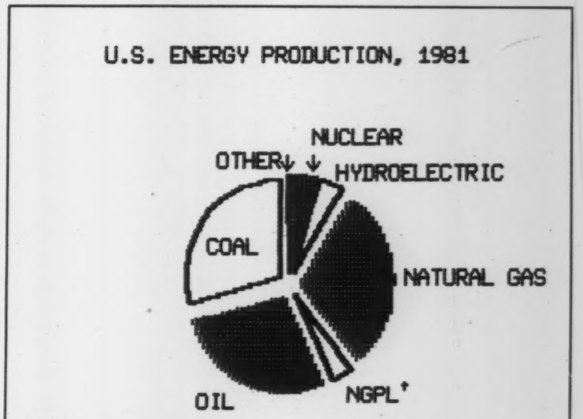


Besides being a clearer display of the data, this graph shows that cheaters sometimes prosper in computing. I said that *Apple II Business Graphics* has no option for producing segmented bar graphs, yet I have just shown you one. How? I cheat. First I entered the rural population data and drew a set of filled bars. Then I entered the total U.S. population data and drew another set of bars (in the same place) with the FILL set to OFF. The blank inside each bar is then the urban population.

Pie Graphs

Another way to show fractional parts of an aggregate is with a pie chart. Normally you use a pie when only the relative sizes of the fractions interest you. For example, the following chart shows U.S. energy production by source.

Graph 9.



*Natural Gas Plant Liquids

Source: U.S. Department of Energy

You don't control the size of the pie, nor can you overlay a pie on another chart. Unfortunately, neither can you highlight one of several slices by offsetting it from the rest.

But the essential capabilities are there. You can draw a pie with each slice clearly distinguishable from its neighbors. You can control the colors that create this distinction. The program automatically labels the slices, and you can put additional labels on the graph. You can even draw a pie with a slice missing, to show that your data don't cover the universe of interest.

Titles

One of the most appealing things about *Apple II Business Graphics* is the flexible way it handles titles for all these graphs. There are four flavors: a general title, a vertical title printed to the left of the vertical axis, a horizontal title printed below the horizontal axis, and floating titles—as many as you want—printed anywhere. Any of these titles can be printed in both upper- and lower-case characters, and 26 special characters (including trademark and copyright symbols) are also available.

The real beauty of this scheme is in the floating titles. You can print them horizontally or vertically, and you can use them to label curves in a line graph, bars in a bar graph, slices in a pie graph, or groups of points in a scatter plot. You can also use floating titles to add lines to the general title or a footnote below the graph.

Business Graphics, continued...

Other Features

In addition to drawing lines, bars, and pies, you can list descriptive statistics, develop a frequency distribution, "smooth" the data (unweighted moving average), or fit any of five curves (constant, line, parabola, logarithmic curve, or sine curve) to the data. You can even use the curve-fitting or smoothing options for forecasting, though I urge extreme caution—especially with parabolic and logarithmic curves.

There is also a "TAKE file" feature similar in concept to Apple DOS EXEC files: it automates a sequence of commands, executing them from a disk file as though the user had typed them from the keyboard. With this capability, *Apple II Business Graphics* has some of the features of an electronic slide show system.

Using the Program

We have discussed what *Apple II Business Graphics* can do, but how easy is it to make the program do it? We will look at that question in two parts. First, how easy is it to enter and manipulate the numbers? Second, how easy are the commands to remember and use?

Data Entry and Manipulation

Apple II Business Graphics defines data in terms of "points." A point is a pair of coordinates, specifying a unique location on any graph. Either or both of these coordinates can be a label or a number.

Once entered, the data can be changed in several ways.

You enter data to the program in a variety of ways. Most people will probably just use the program editor, but there are alternatives. For the *VisiCalc* fanatics in the audience, *Apple II Business Graphics* accepts data directly from *VisiCalc* print files. It also accepts files stored in the Data Interchange Format (DIF), and data from text files stored on DOS 3.2.1, DOS 3.3, or Pascal/Fortran disks. The manual includes details on the structure of these files.

But even fanatics will often find themselves using the editor. You probably got some idea of the editor from following the example for Ms. Big: you type the horizontal coordinate, type a comma, then type the vertical coordinate. An entry beginning with an alphabetic character is assumed to be a label, and numbers can be made labels by enclosing them in quotes.

Once entered, the data can be changed in several ways. You can CHANGE, DELETE, or INSERT with the editor. You can also transform the data mathematically by Adding, Subtracting, Multiplying, or Dividing either a constant or the values in a saved file. Logarithmic transformation is not offered, unfortunately. You also have a SHIFT function, which is equivalent to the "lead" and "lag" time-series functions. Finally, you have cumulative SUM and point-to-point DIFFERENCE functions available.

Command Language

By now you probably have a general feel for the commands *Apple II Business Graphics* accepts, but notice the language in which they are written. In both vocabulary and structure it is similar to English. Commands begin with English verbs like EDIT, SET, DRAW, and MULTIPLY. A noun and sometimes a modifier to either the verb or the noun may be added, and the result sounds like an English sentence: EDIT LABELS, SET COLOR WHITE, DRAW PIE, MULTIPLY BY 100, and so on. Such a command language feels familiar, because it exploits the user's familiarity with his natural language.

Other advantages flow from the same source. For a language as flexible as this one, it is easy to learn and easy to remember. More important, it has the scope and simplicity that are jointly necessary for a comfortable, creative interaction with the computer. Since designing graphics is a creative process, this kind of interaction is a tremendous asset.

Output

With all of the above features, you should be able to draw almost any graph you need on the high-resolution graphics screen. (Those with 80-column cards should test compatibility with *Apple II Business Graphics*—not all 80-column boards can display high-resolution images.) But can you put the graphs on paper?

Apple II Business Graphics will output to Apple Silentype and Qume Sprint 5 printers and to some plotters, according to the manual. For other printers, there are programs designed to print a high-resolution picture from the Apple memory. If you have one that uses Pascal-format files, you can print from screen files saved by *Apple II Business Graphics.* If your print program expects DOS 3.3 files, you can still use it: 1. Draw your graph, 2. Put your print program in drive 1, 3. Press RESET. When you press RESET, *Apple II Business Graphics* tries to reboot, and boots your graphics printer instead. Your graph should be intact on hi-res page 1 of memory, and you can then print it.

File Management

Probably the weakest part of *Apple II Business Graphics* is the way it manages disk space. As in Apple Pascal, deleted files leave gaps on the disk. Files must be stored in a set of contiguous storage blocks, so gaps created be deleting smaller files are usually unavailable for storing larger ones.

Despite what the manual says, *Apple II Business Graphics* tells you only how much total space is left on the disk. So, one day you will try to save a screen file (requiring 16 blocks of storage space) on a disk with 21 free blocks, and the SAVE command will fail (? VOLUME IS FULL). This means that the largest chunk of disk storage has less than 16 contiguous blocks in it. Worse, there is no utility in *Apple II Business Graphics* comparable to Pascal's Krunch—so you can't fix the problem. If you have Pascal, you can run the Pascal Filer against your *Apple II Business Graphics* data disks. If not, use more disks.

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Business Graphics, continued...

Summary

I have offered both kudos and criticisms in this article. As Ms. Big might ask, "What's the bottom line?"

Of course that question is never as simple as it sounds. In this case I think three evaluations are important: 1. Does the program do what a graphics program should, 2. Is it easy to use, and 3. What are the extras offered and the limitations imposed?

My answer to part one is a unqualified "Yes." The essential business graphics are all there. The quality of your product is limited much more by the output device than by the program. With a pen plotter, you can produce professional quality business graphics.

The limitations tend to be more inconvenient than debilitating.

Not only can you do what needs doing, but you can get it done quickly and easily. I like the feel of using this system. It doesn't get in your way. Rather, it efficiently handles the drudgery, so that you are free to sit there and create.

As far as extras and limitations are concerned, there are some important instances of both; but I judge the balance to be far on the plus side. The extra capabilities tend to be very useful, while the limitations tend to be more inconvenient than debilitating. I suppose that the computer will become the ideal knowledge tool when the least sophisticated user is more limited by his own ingenuity than he is by the system he is using. We aren't there yet, but I think that *Apple II Business Graphics* is a significant step in the right direction. ☐

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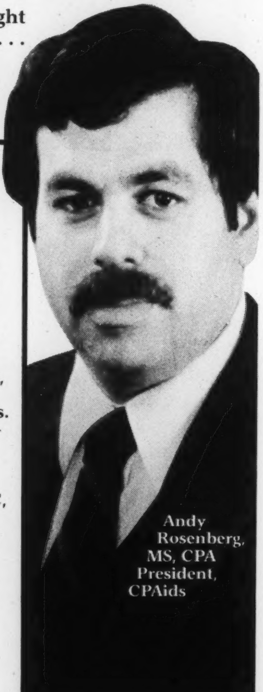

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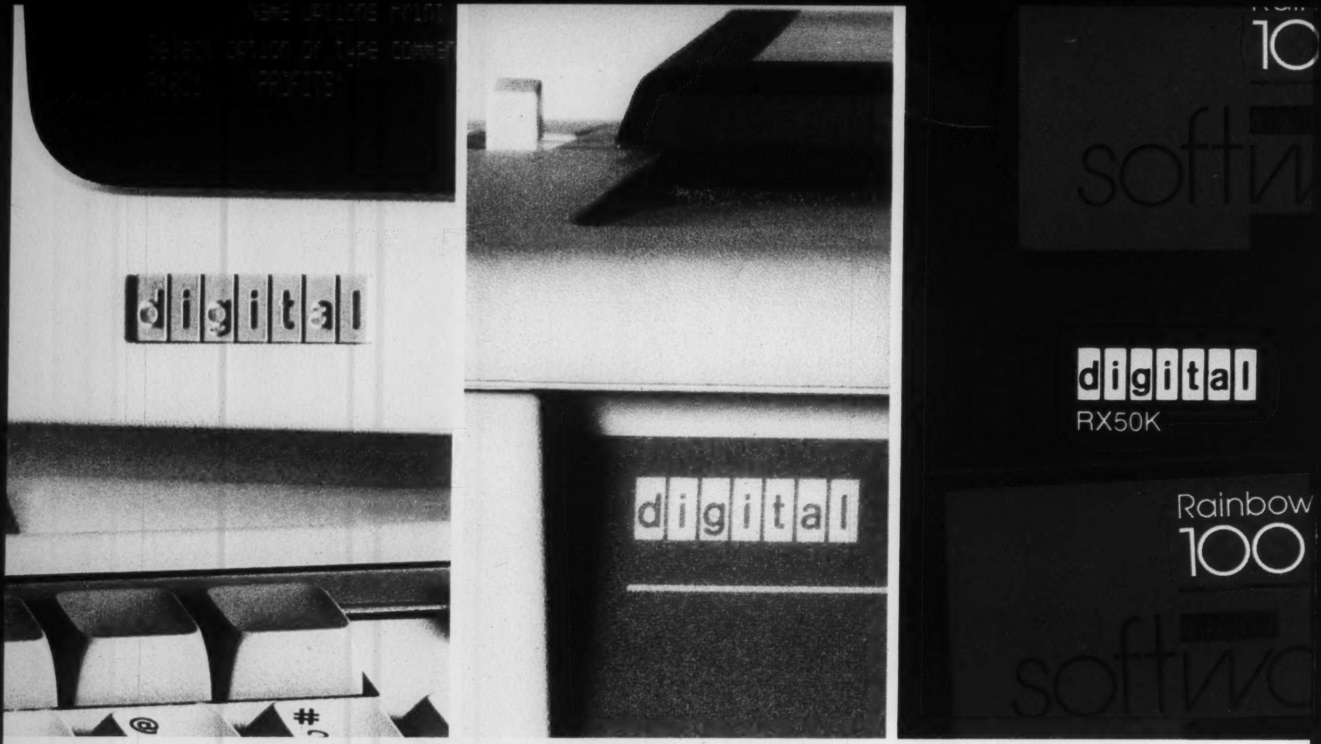
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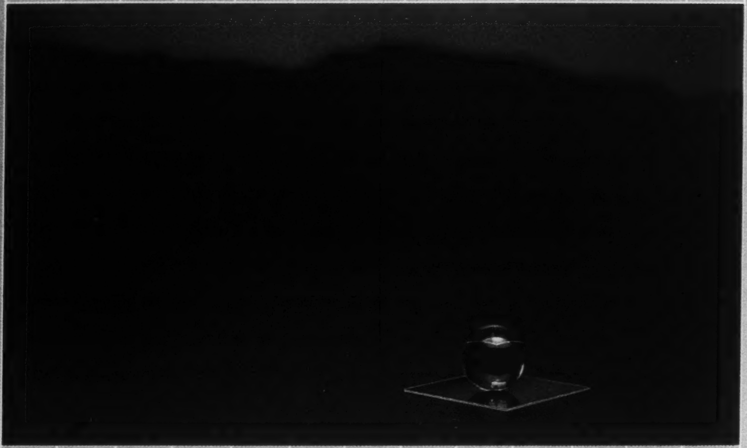

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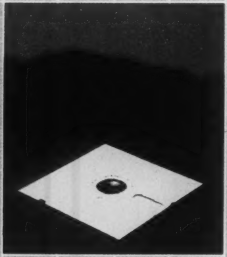

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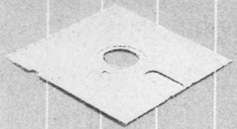

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Four Database Programs For The Color Computer

Scott L. Norman

Among the most useful tasks a personal or household computer can perform are the storage, ordering, and selective retrieval of alphanumeric information. The information may consist of lists of addresses and telephone numbers, household inventories, or a variety of personal histories; it really isn't important which. The point is that the manipulation of this sort of data is an appropriate task for today's civilized micros.

It is possible for enthusiasts to write their own database programs, even if Basic is the only language available. However, it can take quite a while to develop a suitably flexible, bug-free program. Add to this the motivation of making computer-based information management available to non-enthusiasts, and you can see the desirability of ready-to-run database manipulation packages.

In this article, I will review four such packages which run on the Radio Shack TRS-80 Color Computer: Trans Tek's *C.C. File* (formerly known as *Quad Data Base*), Computerware's *Color Data Organizer*, Wizard Software's *E-Z File*, and Radio Shack's own *Color File*.

The popularity of the Color Computer is growing, and so is the list of database management systems for it. My selection represents software with which I have become familiar over a period of time. I believe that it represents a good cross section of the moderately priced software available.

The four programs differ in flexibility, in features, and in format. *C.C. File* and *Color Data Organizer* are available on both cassette and disk, *Color File* comes in a ROM pack and uses cassettes for data storage, and *E-Z File* is on disk only.

I have chosen the disk versions of the first two for convenience; in fact, my copy of *Color File* also resides on disk, but still uses cassette I/O. All of these programs will run on 16K machines. Finally, please note that these programs are intended for "stock" Color Computers, and do not require either of the advanced operating systems (Flex or OS-9) now being used by people who have modified their machines for 64K operation.

C.C. File

Trans Tek's Bill Dye has said that the Quad in the old name of this program stood for "Quick And Dirty," and it is true that the program is both easy to learn and relatively free of extra features. Don't underestimate it, though; *C.C. File* deserves high marks for flexibility and user-friendliness.

Its most attractive feature is the ability to accept data in free form. This

creative computing

SOFTWARE PROFILE

Name: C.C. File (formerly Quad Data Base)

Type: Database manager

System: 16-32K TRS-80 Color Computer

Format: Cassette and disk versions furnished on a single cassette

Language: Color Basic

Summary: Best buy of the bunch

Price: $7

Manufacturer:
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means that there is no predefined format for the records which make up a database file, and in fact the records within a given file do not even have to have the same structure. The various fields within a record do not have to be identified ahead of time as to their alphabetic or numeric character, either.

To appreciate the freedom which this gives the user, suppose that *C.C. File* were used to maintain a personalized address/telephone directory. You might begin with entries having the address before the telephone number, but you could switch at any time and reverse the order for part of the directory. If it suited you to have the number first, then the address, and then the name, that would be all right, too. The search routine finds a key string regardless of its position in a record.

I will get to the mechanics of all this in a moment, but first a few preliminaries: You receive both cassette and disk versions of *C.C. File* in ASCII format on a single cassette. Since the program is written in Basic, it is a simple matter to SAVE or CSAVE your working copies in conventional tokenized form.

As I mentioned, I have used only the disk version, and although the cassette version seems to offer the same options, I must admit to being devoted to the speed and convenience of a disk system for file manipulation.

In any case, when *C.C. File* is run, it begins by asking for the name of the database to be read. If you are starting from scratch, you enter NEW and are prompted to assign a name. Obviously, several databases can be stored on a single disk; a given database can consist of up to 300 records.

Once you have named the new database, you are presented with a master menu. There are only four choices, Search and Print, Search, Update, and Quit. The Update option is used for writing the initial data, as well as for changing it at any later time. Here is where you first encounter the joys of free form data entry; each record is simply entered as a single alphanumeric string. The individual fields are separated by the @ symbol, which is replaced by a carriage return when the record is later printed or recalled to the screen by the search routine. As an example my entry in someone's electronic address book might be

```
Scott L. Norman@8 Doris Rd.
@Framingham, MA 01701@
(617)101-0101
```

(No, I don't really have a binary phone number!) This would be properly formatted when subsequently displayed.

The @ sign is one of only two special control characters in *C.C. File.* The other is the "greater than," >, which generates ten blank spaces in a printout or CRT display. This is handy for indenting code fields on mailing labels, for example. It is important to allow for the proper number of characters associated with @ and > when composing your entries, since a *C.C. File* record is limited to 250 characters overall.

If you make an error while entering a record, you merely backspace and type it again—just as in Basic. Once you have hit the ENTER key, though, it is necessary to get into edit mode to make corrections. The editing procedure will be familiar to users of Trans Tek's *C.C. Writer* word processor; it is more complicated to describe than to do.

First, return to the master menu with the Q (Quit) command. Next, select the Search option, and receive the prompt for keywords LOOK FOR>. Enter any string which unambiguously identifies the record you want to change and it will be displayed, fully formatted.

The bottom of the screen now contains a secondary menu with four choices: Delete, Print, Edit, or an arrow symbol. The first two are self-explanatory; the arrow indicates that the up and down arrows on the keyboard can be used to scroll back and forth through the database. The Edit option causes the displayed record to revert to the string format in which it was entered, complete with @ and > symbols. Now, however, there is yet another menu on the screen: (I)nsert/(C)hange/ (D)elete.

The cursor can be positioned anywhere in the record with the arrow keys. Typing I causes the text to open up to receive insertions, the C lets you overtype and correct text, and each time the D key is pressed the character to the right of the cursor is deleted. You can recover the formatted version of the data by pressing ENTER and return to the master menu with the Q command.

In covering the editing procedure, I have actually touched on most of the features of *C.C. File*. As you have probably guessed from my description of the Search option there are no privileged keywords. The ability to search on any substring means that our hypothetical address book database could be searched by last initial, zip code, or telephone area code.

C.C. File *provides a simple, inexpensive way to add rudimentary database management capability to the Color Computer.*

You can set up keywords if you wish, though. For example, you might make the convention that keywords are to be denoted by a leading asterisk or other special character (except @ or >, of course). You do pay a small price for this simplicity, though. For one thing, the match to a search key must be exact: uppercase and lowercase characters are distinct from one another. Also, it is not possible to logically combine search criteria with AND or OR; these would just be considered part of the search key by the program logic. A final point is that it is not possible to quit the search routine at any arbitrary stage. You must page through all successful "hits" resulting from your search criterion.

What about some of those other options? Recall that the Search routine gives you the choice of printing each hit or skipping to the next one. The master menu also has a Search and Print option, which prints each and every hit. If you enter a null line in response to the LOOK FOR prompt in this option, the entire database will be printed out. I have already mentioned the Q command for returning to the master menu from the edit routine: entering a Q from the mas-

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ter menu itself causes the database to be written to the disk or cassette in ASCII. You then exit the program and return to Basic.

Summing up, *C.C. File* provides a simple, inexpensive way to add rudimentary database management capability to the Color Computer. Its command syntax is easily learned (especially for *C.C. Writer* users), and the on-screen prompts make it difficult to get badly lost. To be sure, the program lacks the ability to sort and merge files, but in my opinion it remains a best buy.

Color Data Organizer

Computerware's *Color Data Organizer* is also written in Basic and has both a file sorting capability and a provision for selecting records according to numerical limits which the user sets on data fields. Unfortunately, there are rather stringent limits on both the length and format of records. Each can contain at most four fields: two numeric, two alphanumeric. The numeric fields may be up to nine digits long (the display switches to scientific notation for larger or smaller numbers), while the alphanumerics are restricted to 16 characters. As a result, the program is useful only for very restricted types of data. It would probably serve for home inventories, for example, but not for address book applications. The disk version of *Color Data Organizer* can handle up to 255 records; the cassette version can work with only half as many. Either will run in 16K, and in fact having a 32K machine is no advantage; this program lacks the dynamic memory allocation capability of *C.C. File*.

Like the other database managers reviewed here, *Color Data Organizer* uses nested menus to guide the user through the many options. The menu structure is fairly complex, however, and places responsibility for a surprising amount of detail on the user. For example, users must issue specific commands to open and close disk files, a chore which is normally automated in such programs.

A fresh disk contains three programs: DATA-ORG, which is the *Color Data Organizer* program itself; DATA-CON, for converting cassette data files to disk format; and a sample database named DATAFILE. Before starting work with a 16K Color Computer, you must enter the commands PCLEAR 1 and FILES 2 to allocate sufficient memory; this is unnecessary with a 32K machine. The first display is the Master Menu, with four entries: Storage Control, File Control, Sort-Print, and Basic.

Almost all responses are made with a single number. No matter what you are planning to do with *Color Data Organizer,* your first selection is Storage Control, which has its own menu: Open, Close, Directory, Create, and Return. The first two options open and close disk file buffers, Directory lists all files with DAT extension, Create defines the names of data columns for a new file, and Return brings back the Main Menu.

Here is the procedure for building a new file from scratch. Choosing the Create option of Storage Control, you are presented with a third-level menu which asks for the titles to be assigned to the four data fields. The numeric columns are specified first, and input data are later called for in this order. When you have entered and approved all four titles, you are asked for a filename. There is an explicit (if small) warning in the instructions not to specify an extension; the program assigns /DAT to all data files. With the filename and data column headings specified, the program writes the name onto the disk (drive 0 assumed). The Storage Control menu then returns.

Ready to enter data? Select the Open option of Storage Control and you are prompted for the filename. The disk is read and the Main menu returns; now select the File Control option. This time there are only three options on the second-level menu: Input, Look, and Return. As you might expect, Input is used for data entry. The third-level menu prompts you for the four data fields in turn, and upon completion, gives you the option of re-doing the whole record or approving it and going on.

There is also a running display of both the next unused record number and the total number of records still available for your file. When you have finished, an M command gets you back to the File Control menu. Before you can call it quits, though, you still must return from File Control to Main, then go back to Storage Control to give the Close command. Disaster awaits if you remove a disk or quit the program without closing the file buffers.

One quirk in the system: The program drops leading zeros from numerical data, which can make zip codes look rather strange.

What about some of those other options? The Look option of File Control is used for viewing, deleting, or changing data already stored in files. Once again, it is necessary to bounce back and forth between the Main, Storage Control, and File Control menus. The third-level menu for Look asks you for a beginning record number and then it displays a command line giving your options: (F)orward one record, (B)ack one, (N)ew record somewhere else in the file, (C)hange the displayed record, (D)elete it, and (M)enu, which returns you to File Control. If you select C, you must re-enter all four fields—there is no finer selection or change process. The D option clears alphanumeric data fields to blanks and puts zeros in the numeric fields, but does not renumber subsequent records to close up the file.

Unfortunately,* Color Data Organizer *lacks a capability for selecting records according to keywords or other strings.

The Main menu has one more selection which I haven't explained: Sort-Print. This is actually one of the better features of *Color Data Organizer.* The second-level menu gives you, naturally enough, Sort, Print, and Return (to Main menu) options. Sort causes the titles of the four data fields to be displayed and asks which one you wish to sort on; the sort will be in ascending order. The disk drive goes on as soon as you respond, since this option rewrites your file.

The sorting routine isn't especially fast, being written in Basic, but at least you have the option of using either numeric or alphabetic data to order your file.

The Print option is fairly versatile. First, you are given the choice of printing in a 40-column label format or an 80-column report format. The former prints each field on a separate line, in the entry order: both numerics, then both alphabetics. The title of each field is printed to its left.

The 80-column format is more flexible, allowing the user to specify the order in which fields are to be printed. The four fields of each record are printed on

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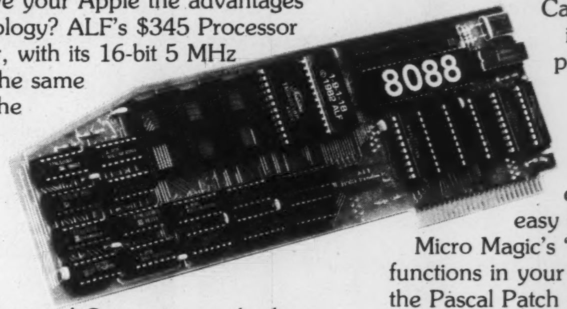

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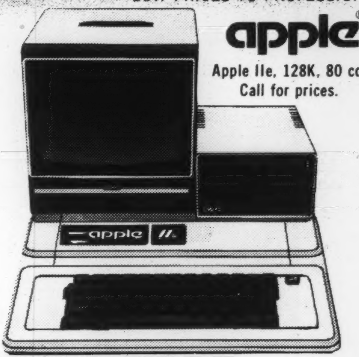

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a single line with titles at the top of the printout. You are also allowed a limited degree of selectivity in choosing the records to be printed. This takes the form of setting inclusive upper and lower bounds on the data in one of the fields. Finally, you can specify that the data in either of the numeric fields (but not both) be totalled at the bottom of the report.

Unfortunately, *Color Data Organizer* lacks a capability for selecting records according to keywords or other strings. The setting of bounds for print selection is your only option along these lines.

How to characterize this program? I must confess to being disappointed. The data format seems just too restricted to be of general utility, although I can imagine using it for some technical data, where the scientific notation feature might be appreciated. I also think that the ability to select records from a database for on-screen examination is absolutely essential, and that some sort of keyword capability should have been included.

Finally, although the whole Storage Control/File Control system is less cumbersome than it may have sounded from my description, it is still more cumbersome than it should be. In fact, this is my principal criticism of the program. I feel that database management systems should serve the user who is indifferent to the charms of the computer and who merely wants help in organizing his information.

E-Z File

This is a rather quirky, frustrating program. Although most of the operations of *E-Z File* are straightforward, there are just enough oddities to be annoying. In addition, there is one absolutely crucial omission in the documentation; if nothing else, I hope that this review can rectify that particular oversight.

The *E-Z File* disk contains three programs. A short loader called GO sets up the storage parameters and loads the main program, which is itself called E-Z FILE. The main menu of 16 options is then displayed. There is no printed documentation; instead, the user is advised to use the Load File command to call up E-Z INST, the third disk file. You can then display the complete set of instructions by invoking the List File option.

The instructions aren't especially long, and I am all for generous on-screen prompts, but, I do think that a set of written notes should have been included. It is possible to generate your own by using the Print File option, but the printed format is very poor. There is also evidence that the program has been undergoing modification at a rate too fast for its own good. There are several discrepancies between the option numbers assigned by the on-screen menu and the instructions. The menu is correct in all cases.

It is probably simplest to run through the menu selections in numerical order. Number 1 is called Give to New File on the screen and Create New File in the instructions. At any rate, it is, indeed, the choice for starting out to build a new database. When you select it, the screen clears, and you are ready to enter the first record as a single string of up to 249 characters. A dark graphics block is set at the proper position to remind you of the length limitation, and the prompt RECORD: 1 appears at the bottom. When you have finished with the first record, the ENTER key generates the prompt for the second, and so forth.

Unlike *C.C. File*, *E-Z File* does not use special delimiter characters to separate the different fields within a record. If you want a multi-line format at this point, you must enter a series of blank spaces to position the cursor. There is an easier way to go about this, and I will discuss it below when I get to the Edit option. Right now, though, I must bring up the documentation flaw that I mentioned.

There eventually comes a time when you have entered all the material for your database and want to return to the main menu to name and save it. But how? The instructions don't give you a clue. A null line (the ENTER key by itself) doesn't work—it just generates a blank record and brings up the prompt for the next one. Well, folks, it seems that *E-Z File* uses its own null character, and it's a beauty: two exclamation points separated by the number sign. That's right, the !#! combination terminates data entry. It doesn't actually get the menu back, though. It returns the first record in your database, and you must then step through the whole thing (using any key) until you reach the end. Then, and only then, does the menu reappear.

The idea of using a special character or series of characters to mark the end of the data entry process may be worthwhile. However, I must take Wizard Software to task for leaving the user in the dark. I only stumbled upon the !#! combination because it is also used in the Search and Replace routine to indicate a null replacement string. Let's hope that future documentation corrects this error, because the overall performance of *E-Z File* is far from shabby.

Assuming that you have gone through the data entry phase and gotten back to the main menu, Option 2 (Edit) may be in order. The editing procedure is similar to that employed by *C.C. File*, with the same Insert, Delete, and Change options. The four arrow keys control cursor movement, and there is an autorepeat feature.

You start with the first record in the file and advance by moving the cursor to the end of each record in turn. A prompting line at the bottom of the screen gives the numerical value of the current cursor position, the number of the record being edited, and the total number of records in the file.

The Change option is more flexible than that of *C.C. File*, since it can be used to add material past the end of the original record. This paves the way for better formatting. The idea is to place the cursor just in front of the last character in the original file, hit C, and start typing. In this mode, the ENTER key is recognized as a linefeed (instead of a call for the next record, as in Option #1). Thus you can use ENTER to set up a multi-line record.

The whole process is a little awkward, though. It calls for entering just the first line of data for each record on the first (Option 1) pass, and adding the rest on a second pass under Option 2. Is it worth it? It all depends on how much you care about the appearance of your database.

Option 3, Add to Present File, is quite simple. It just sets up the prompt for the next unused record number, and data entry proceeds as usual.

Option 4, is Search and Replace. You are prompted for the target string for the search and for a replacement string. As in *C.C. File*, there are no privileged keywords. If you just want to examine your "hits," and not necessarily change them, you answer the second prompt with the notorious !#! combination. The program displays each hit in turn, and informs you of its entry number in the database and the cursor position at which the hit was found. Any key will advance you to the next hit, if there was

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SOFTWARE PROFILE

Name: E-Z File
Type: Database manager
System: 16-32K Color Computer
Format: Disk
Language: Color Basic
Summary: Not bad, but
documentation is lacking
in early versions
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more than one. When you have reached the end of your hits, you get a DONE message; pressing any key will return you to the main menu.

If you know at the outset that you want to replace your target string, you enter the replacement in response to the initial prompt. Unfortunately, in this mode you never see the actual hits—just the DONE when the whole process is finished.

Options 5 through 7 allow you to kill, save, or load a data file. They are quite straightforward. You just supply a filename when prompted. Files are saved in ASCII format.

Option 8 is used to get a screen listing of a file after it has been loaded into memory. You get one record at a time, starting with the first and must scan through the entire file before you can do anything else. There doesn't seem to be any way to break off in the middle of things. If you want a printed list, use Option 9; you are given the choice of deleting the record numbers from the printout. By the way, the print is single-spaced with no extra spaces between records. To spread things out, you must insert additional linefeeds with the Edit option.

E-Z File *could be a serious contender for your database dollar.*

Option 10, Auto Header, is used when setting up a new database. It allows the user to specify a header which will be repeated automatically at the top of each record. If this feature is desired, it should be the first option used in the setup procedure. It will call Option 1 after the header is specified.

Option 11 allows you to change the default disk drive number for loading, saving, or killing a file from zero to another value. Option 12 toggles the Verify command on and off.

An *E-Z File* database can be sorted into ascending order with Option 13. That's the good news. The bad news is that each record is treated as a single string and sorted from the beginning. There is no capability for sorting on an interior field, or for sorting into descending order. The sorting routine handles all ASCII characters, however.

Options 14 and 15 are used to modify existing databases by inserting or deleting individual records, while Option 16 returns you to Basic. If you choose to insert a record, you will be asked for the number of the entry after which you want to make the insertion. If you respond with ENTER, your insertion becomes the new entry #1. Of course, the sorting routine can be used to straighten things out later.

I have gone on at some length because of my distress at the flaws in the documentation of *E-Z File.* To be sure, it isn't the perfect database manager; there are too many processes requiring the user to cycle through the complete file, for example. Still, the program deserves a fair shake. The naive user doesn't have to worry about a multitude of nested menus, and many of the operations are really rather straightforward. If future versions are supplied with adequate documentation, *E-Z File* could be a serious contender for your database dollar.

Color File

The last of my review subjects, Radio Shack's *Color File,* is the most powerful in many ways. It is furnished in a ROM pack, leaving almost all of RAM free for data. About 15,000 characters can be stored in a 16K computer. Of course, this means that cassettes must be used for data storage, which does slow things down. Based on the amount of tape used, I would assume that the files are recorded in ASCII. *Color File* is written in relocatable machine code, so that I was able to copy my version onto disk. Of course, I still have to use cassettes for data, but at least I am no longer required to unplug the disk controller every time I want to use the database system.

Color File has a fairly complete set of commands for re-ordering the records in a file, selecting records, and printing the results of the selection processes. On-screen prompts are always available and do a good job of keeping you informed of where you are in the menu hierarchy. As a final touch, the program comes with seven predefined file formats: Addresses, Warranties, Home Inventory, Investments, Auto Maintenance, Medical History, and Resume/Vita. You can define your own formats, too.

creative computing

SOFTWARE PROFILE

Name: Color File
Type: Database manager
System: 4-16K Color Computer
Format: ROM pack
Language: Machine language
Summary: Powerful, flexible, uses cassettes for data storage
Price: $29.95
Manufacturer:
Radio Shack
One Tandy Center
Ft. Worth, TX 76102

When the program is fired up, it first asks if an old field is to be loaded. If you are starting afresh, you next get the menu of predefined formats. Let's work through the construction of an address file.

The next prompt is for a filename. Since this is a cassette-oriented program, the filename is not strictly necessary. It does make it easier to locate the correct file on the tape, of course, and is to be recommended. After you supply the name, hitting ENTER twice brings up the file structure (seven fields, plus their names) and a command line at the bottom of the screen.

At this point, the command line contains the master menu:

ADD CHG DEL SEL ORD TAP PRT

Taken in order, these allow you to add a record to the file, change the current entry, delete it, select a group of entries for display, put the file in order, save the file to tape, and print selected entries. At this point, the ADD is highlighted, which indicates that it will be implemented if the ENTER key is pressed. In fact, that is the only option available for an empty file.

When you press ENTER, a cursor appears in the first position of the first field. At the same time, the command line changes to display the second-level menu. For the ADD command, this is:

ADD NO! MOR

with ADD highlighted again. Now it is time to enter data (name, address, city, etc.) for the first record, with the ENTER key generating a linefeed in the usual way. Only uppercase letters can be used for alphabetic entries, and at this point your editing capability is very limited. You can correct the current line by backspacing and overtyping, and that's all. When you reach the end of the first record, you can add it to the database by pressing ENTER once again, or you can invoke one of the other options with its first letter.

NO!, which also appears in several other second-level menus, cancels the current option and returns the main menu. MOR is used for general editing of a complete record before it is added to the file. Now the four arrow keys can be used by themselves to position the cursor, or in conjunction with the SHIFT key to perform editing functions such as insertion or deletion of spaces, or the deletion of a line. There is no auto-repeat function.

After each record is added to the file, you return to the main menu and are prompted with another blank form. When you are finished, you can move on by pressing the up arrow. The display shifts to a kind of title page, giving the

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name of your file, the total number of entries, and the first fields of the first and last entries. New users are often surprised to find that the database has already been sorted in ascending order according to the first field—machine language sorts can be very fast.

As I shall describe later, you can rearrange the order of records quite easily. You can review the database by using the arrow keys now. Press ENTER to leave the title page for the first record, then use the right and left arrows to move forward or backward through the file. The down arrow moves you to the final entry, and the up arrow returns the title page.

Color File *makes it fairly simple to carry out all of the standard operations on a complete file.*

Color File makes it fairly simple to carry out all of the standard operations on a complete file. Pressing ENTER when the last record is on display gets you back to the ADD function to add another file, for example. If you want to change something you see when reviewing one of the records, enter C for the CHG option. You get the appropriate second-level menu: CHG NO! MOR.

CHG allows you to use the arrows and SHIFT key as before to perform editing. If you go all the way through a record and still want to do more editing, use the MOR option: you can't select CHG twice in a row for a given record. If you decide to delete a complete record, just select DEL. This has a simplified menu: DEL and NO!.

The real advantages of *Color File* lie in its provision for sorting a database and selecting records from one. It is worthwhile to describe these operations in some detail.

The second-level menu for the Select operation is:

SEL NO! FLD ALL = # < >

At the right of the command line, in reverse video (dark on light, for this program), is a box reading FLD= followed by a number. This is a reminder of which field currently provides the basis for the selection process. The default is Field #1. The general procedure for setting up a selection operation is as follows (note that you can do this with any record on display, not just one which satisfies the selection criterion):

1. Define the selection field by entering F and responding to the prompt with the field number. Items could be selected by zip code from the address book example by specifying Field 6, for instance.

2. The cursor moves to the first position of the designated field. Now enter the value to be used in the selection (the key). If there is any additional material in the key field of the particular record on display, clear the rest of the line.

3. Specify the selection criterion, using one of the last four options on the menu. You can designate "hits" as having a match with the key (=), as having a total mismatch (#), or as having the designated field greater than or less than the key (>, <). The selection criteria work with both numeric and alphabetic fields, with this ordering convention: Punctuation marks before numbers before letters. If you choose the = criterion for a numeric field, your hits will have to exhibit exact equality with the key. Alphabetic fields use a criterion like the Basic INSTR. A hit is made if the key appears anywhere in the designated field.

4. Use the Select option to perform the search.

The machine language search routine is very fast. The selected records form a separate database which can be resorted, printed out, or used as the basis for further selections. This allows you to combine search criteria. For example, it would be possible to find everyone in the address book whose last name begins with N and who lives in Massachusetts.

Using the selection routine does not cause any of the original data to be lost; you can get the whole database back by going to the second-level Select menu and choosing the ALL option.

What about changing the order of a file? This employs the ORD selection on the main menu, and generates the second-level menu

ORD NO! FLD ASC DES

plus an FLD= reminder like the one in SEL. The new options, ASC and DES, are used to specify ascending or descending order for the sort; the other options should be familiar by now. When you save a file, the last sorting criterion is saved along with the data.

The final options on the main menu are used for saving a file on tape and for printing it. TAP gives you the option of making two copies of your database. Note that it doesn't let you record a separate database, using records selected from a larger file, you always wind up with the whole file on tape. This is probably a reasonable safety feature.

The way to beat it, assuming you have already made a safety copy of your whole file, is to set up a selection criterion which picks out the records you don't want, then delete them, one at a time. Now the ALL option will combine this empty subset with the records left behind by the selection process, which were the ones you wanted in the first place. Recording this should give you the desired subset on tape.

This has been pretty long-winded, but I think it demonstrates some of the real power that *Color File* has. The final touch is the ability to define your own record structure. You can specify up to seven fields, and will be asked for the numeric or alphabetic character of each. All of the *Color File* options are available to user-defined files.

Summing Up

As I mentioned at the outset, this review has treated just those personal database management systems which I myself have used. One thing I have learned is that in software reviewing, as in everything else, personal quirks and preferences play a major role.

I need the ability to select subsets of a database for examination and prefer not to be too constrained in data format. I am also a firm believer in the use of disk systems for maximum flexibility, although the Color Computer system has enough foibles to make me question the wisdom of that.

It is considered bad form in some quarters to admit that you like a Radio Shack product.

Putting it all together, I rate Trans Tek's *C.C. File* an absolute jewel of a best buy. *Color Data Organizer* is just too constrained in format for my taste, and I think it needlessly burdens the user with operating system details. *E-Z File,* in my opinion, still needs work; I hope that the vendor sees fit to produce some printed documentation and fixes some of the rough edges, because there is a useful program in there somewhere.

And that brings me, kicking and screaming, to *Color File.* I like it. It is considered bad form in some quarters to admit that you like a Radio Shack product, rather like playing Mantovani records on a fine stereo system, but there you are. *Color File* is really quite powerful, and the screen prompts are generally enough to keep you on track. If all else fails, you can always get out of trouble by hitting ENTER a few times. My biggest reservation is the ROM pack/cassette storage combination. I encourage Radio Shack to follow up on their work with *Spectaculator* and *Color Scripsit,* and issue a disk version of *Color File;* it's a good program. ☐

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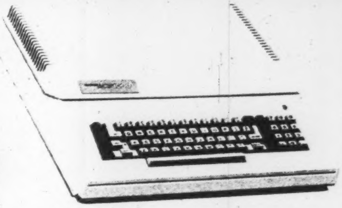

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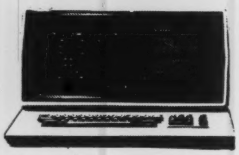

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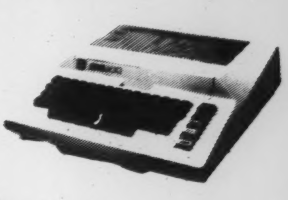

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Going Forth

Thomas McNamee

The finest testimony I can give to Valpar International's ValForth language is this: In 20 hours' time I went from complete ignorance in the Forth language to writing my first Pong game, complete with player/missile graphics and sound. I owe it all to Valpar's great documentation, a book they recommended, and of course, the fast and versatile Forth language.

I have been programming on various micros for two years—all in Basic and assembly language. I had heard of Forth through a friend who worked in a similar language, Stoic. Forth offered many advantages over the languages I was familiar with, but one look at a typical program listing scared me off. I remember thinking that the program looked as if the programmer had been making up the language as he went along. And that turned out to be the secret of Forth—you make it up as you go along.

Based on a set of more or less standardized commands, the programmer constructs his own words to meet his needs. This process builds on itself until the whole program can be run by executing just a few words. For example the word SANDWICH might be made up of the words GET-HAM and GET-CHEESE. These would be further defined as smaller and smaller words. Think of each word as a subroutine made up of ever-smaller subroutines.

I picked Pong for my maiden project because it used many of the features needed for most games—player/missile graphics with collision detection, full control over the standard Atari graphics, game controller interface, and sound. The game runs well, with speed far better than Basic, but only about half as fast as assembly language. The speed loss is barely noticeable, however.

The exciting thing is the composition time. Pong could easily have been written in an afternoon by someone who knew the language well. And the words I defined in Pong can be used in my next game if similar functions are needed. The Forth dictionary (really a library of commands) can be extended indefinitely.

I bought three modules from Valpar: ValForth ($39.95), General Utilities and Video Editor ($34.95) and a disk containing Player/Missile Graphics, a Character Set Editor and a Sound Editor ($39.95). The last two require ValForth to run, and are extensions of the dictionary. Time-critical routines are coded in assembly language for speed. The disks are unprotected, so backups for personal use are allowed. FORMAT and DISKCOPY commands are provided, as is a command to produce your own programs on auto-booting, protected disks. Valpar supports programmers wishing to write programs for publication using ValForth, and requires only that credit be given them in the documentation or on the media.

ValForth 1.1

The primary disk contains all the main routines, the interpreter and the operating system for Forth. It features a basic glossary of words and a figForth editor for creating your own source programs. Graphics, color and sound commands are available on this disk as extensions to the dictionary. Many of the graphics words from Atari Basic (DRAWTO, PLOT, etc.) have been copied here so that learning to use this section is easy.

As much as possible, Valpar has written this package so that what you already know about the Atari computer can be put to immediate use. The Atari operating system is supported with familiar words such as OPEN, CLOSE, PUT and GET. There is a group of words used for debugging Forth code, and words for floating point arithmetic are provided.

For applications in which time is critical, this disk contains a powerful 6502 assembler designed to be used with the Forth system. Macros, conditional branching, and conditional loops are supported, and access to the rest of the Forth language is easy. The assembler itself is worth the price of the disk.

General Utilities and Video Editor

The General Utilities and Video Editor disk contains a fine selection of string utilities, array commands, and CASE statements, and a fascinating group of

creative computing

SOFTWARE PROFILE

Name: ValForth

Type: Language

System: Atari 400/800, 24K minimum

Format: Disk

Summary: Excellent implementation of an interesting language.

Price: $39.95

Manufacturer:
Valpar International
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Tucson, AZ 85713
(800) 528-7070

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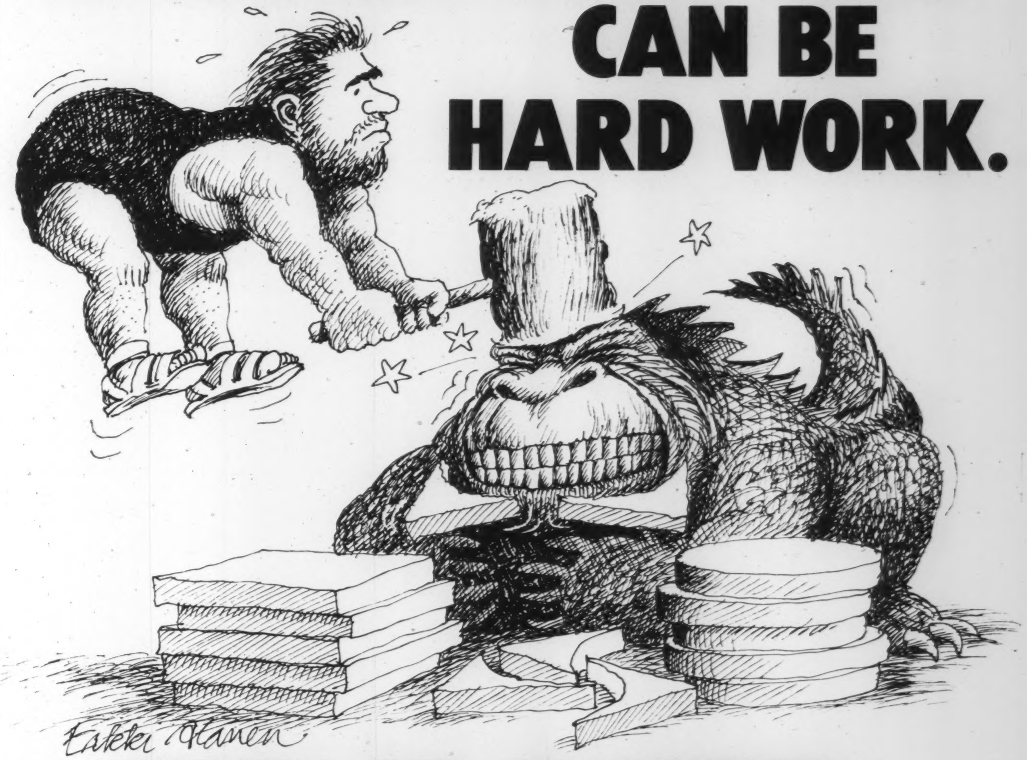

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CIRCLE 277 ON READER SERVICE CARD

words called High Resolution Text. Many Basic words appear in the string commands, such as LEFT$, RIGHT$ and INSTR. There are provisions for comparison, sorting, and formatted output. The string commands are all very fast, since the address of the string is manipulated instead of the string itself. Time is not wasted in what Basic programmers call garbage collection.

CASE structures are a powerful group of commands permitting decision making similar to ON. . .GOSUB in Basic. The SEL structure allows the same advantage for non-sequential numbers. The final word in this group is COND, which allows conditional execution based on true/false testing.

High Resolution Text is a feature permitting text to be displayed in Graphics 8 mode. Words for superscript, subscript, and overstrike are supplied. Using a combination of backspacing, subscript and overstrike, underlining can be accomplished. Graphics can still be drawn in this mode, so displays of mixed text and graphics are very easy.

The ValForth video editor is a joy to use. Again, Valpar could have sold this all by itself and kept the price the same. It is used for entering Forth source code and has a powerful set of single-stroke commands for insertion, deletion, and buffer management. Each screen, of which there are 180 per disk, can be brought up and edited with ease.

When the source code is finished, you LOAD the screens you want to run. As they load, each word is compiled into the dictionary. If an error occurs during compilation, the WHERE command of the editor displays the screen on which the error occurred. The cursor is positioned over the word or character that caused the error.

A visible buffer to or from which lines can be copied appears at the bottom of the screen. The user can set the number of lines it holds. Seven single-stroke commands support line move, line copy, and buffer clear operations. In this way, sections of code can be moved or copied using the SMOVE and COPY commands. The whole editor design encourages the composition of easy-to-read source code.

The ValForth video editor is a joy to use.

Player/Missile Graphics and Friends

The Player/Missile Graphics disk contains an extremely useful set of commands that are a must for any game programmer. Memory allocation, memory clearing, player/missile design, and movement are all reduced to single words. All modes are supported. Player size, multicolor players, and fifth player features are easy to implement. P/M graphics are not destroyed when switching from one graphics mode to another.

Movement is accomplished in two ways. You can either put the player at an absolute X,Y location, or you can move the player relative to its present spot any number of locations.

Collision detection is also available in two ways: boundaries and the standard Atari collision registers. Boundaries can be set for any player or missile. The movement of that character will then be limited to that area. In addition, a variable can be checked to find out when a boundary has been reached and where it is. The direction of movement can then be changed. This is how I made the ball bounce in my Pong game.

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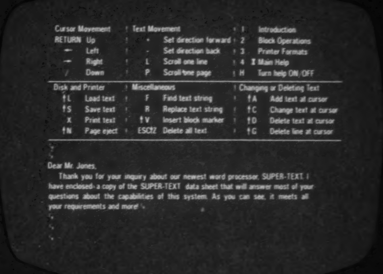

```
Cursor Movement    ! Text Movement              ! 1    Introduction
RETURN  Up         !    +    Set direction forward ! 2    Block Operations
  ←     Left       !    -    Set direction back    ! 3    Printer Formats
  →     Right      !    L    Scroll one line       ! 4  I Main Help
  /     Down       !    P    Scroll one page       ! H    Turn help ON/OFF
--------------------------------------------------------------------------
Disk and Printer   ! Miscellaneous               ! Changing or Deleting Text
  ↑L    Load text  !    F    Find text string    !    ↑A    Add text at cursor
  ↑S    Save text  !    R    Replace text string !    ↑C    Change text at cursor
  X     Print text !   ↑V    Insert block marker !    ↑D    Delete text at cursor
  ↑N    Page eject !  ESC↑Z  Delete all text     !    ↑G    Delete line at cursor
--------------------------------------------------------------------------

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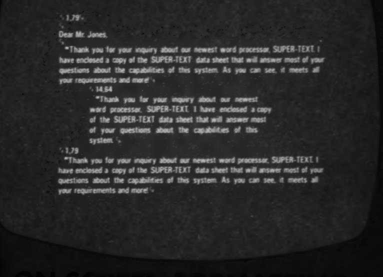

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questions about the capabilities of this system. As you can see, it meets all
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ValForth, continued...

field, missile-to-player and player-to-player collision detection are supported, and there is a general collision flag that is set when anything bumps anything else.

The character set editor allows for the creation of new character sets, as well as the words needed for switching and loading sets. These designs can easily be used in conjunction with player/missile graphics, since a command is available to change any player rapidly to another bit pattern.

The sound editor is a useful "audio pallete" for creating single sounds on any of the four channels. Using joysticks, you adjust the frequency by moving horizontally, and change the distortion by moving vertically. A readout at the bottom of the display shows the current values needed to re-create the sound. In addition, the AUDCTL register can be addressed to produce many interesting sound variations.

Documentation and Support

Each package comes with its own documentation, printed clearly on 8½ x 11 paper and punched for a three-ring binder. All together, there are about 200 pages of information, as well as the source code for each disk. The documentation is excellent, and is very easy to use. It is not a tutorial of Forth, however. The functions common to the language are listed, but the language itself is not explained.

Valpar recommended *Starting FORTH* by Leo Brodie since I was a first time user, and it turned out to be great advice. I have read many technical works, but none as informative and enjoyable as Brodie's. I never met the man but I like him a great deal.

All of the ValForth documentation is written in a participatory style.

The ValForth 1.1 documentation of the main disk begins with simple loading instructions and then, very appropriately, a good section on errors, recoveries, and crashes. The next section is on formatting and copying disks. I recommend that anyone who buys ValForth be sure to have a box of clean disks on hand. Backups are encouraged and very useful. After you have loaded all the features you are likely to use, you can create your own system disk. Forth requires a special disk format, so you will want three or four blanks to work on. Sections on graphics, editing and sound complete this package.

All of the ValForth documentation is written in a participatory style. You sit down and follow the instructions, and when the last page is turned, you know how it works. Technical jargon is kept to a minimum, but it is a good idea to keep Brodie's book nearby.

Any command peculiar to the Atari, such as graphics and sound, is explained fully with examples. There are even example programs on the player/missile disk which are valuable references. Each package is accompanied by a stiff command reference card for quick word look-up.

Before buying this package, I spoke to Mike White at Valpar about support. He was knowledgeable and polite, and he assured me that I could write or call anytime with my problems, and I would get help. He was enthusiastic about ValForth, and seemed to represent a company that sells a good product and stands behind it.

ValForth is an excellent implementation of a fast, expandable language. ☐

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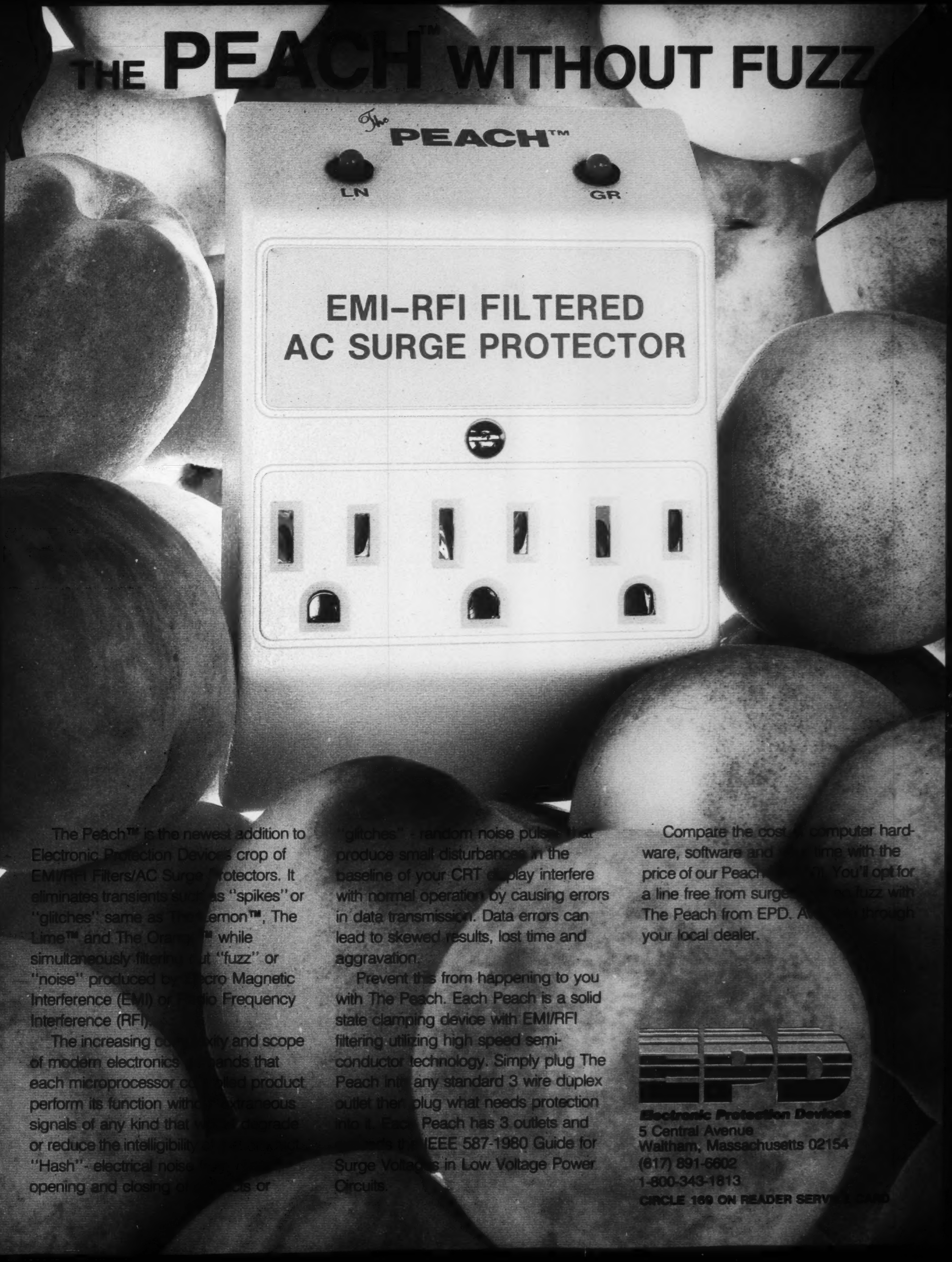

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Prism

Brian J. Murphy

creative computing

SOFTWARE PROFILE

Name: Prism

Type: Storydisk-puzzle

System: 48K Apple II with disk drive and 3.3 DOS

Format: Disk

Summary: A poor children's story, but a great real-life treasure hunt.

Price: $19.95

Manufacturer:

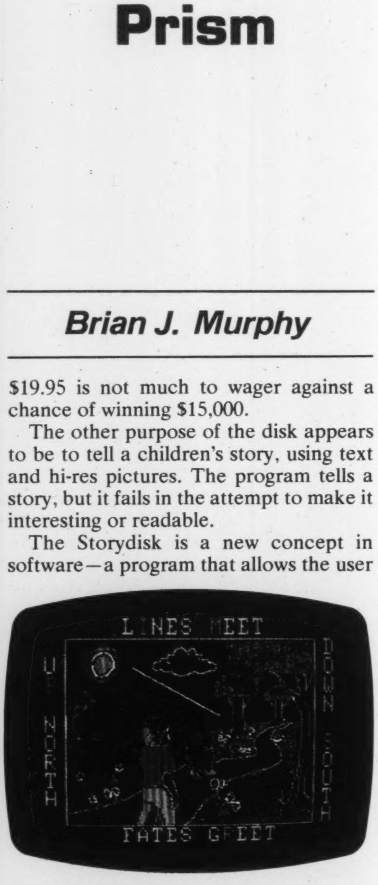
International Software Marketing
Suite 421, University Building
120 East Washington St.
Syracuse, NY 13202

If you think that $19.95 is a reasonable amount to invest in a chance to win a prize valued at $15,000, then *Prism*, a Storydisk released by International Marketing, is worth a look. If, on the other hand, you are looking for sheer entertainment for your children, then *Prism* is not for you.

This new disk, created by a team of programmers and editors at ISM, attempts to fulfill two purposes. One, quite reasonably, is to make money by offering Apple owners the opportunity to decipher a puzzle that will lead to the discovery of three solid gold, gem-encrusted keys which ISM has hidden in three secret locations in the continental United States. The reasoning is that people will come to the conclusion that $19.95 is not much to wager against a chance of winning $15,000.

The other purpose of the disk appears to be to tell a children's story, using text and hi-res pictures. The program tells a story, but it fails in the attempt to make it interesting or readable.

The Storydisk is a new concept in software—a program that allows the user to remain almost completely passive. All the user need do is to hit the arrow key to turn the pages back or forwards. As you "leaf" through the story, the screen fills with either text or hi-res art. The pictures, which are the best part of the program, were created by Mike Sullivan. His pictures are detailed and elegantly drawn; some feature a limited amount of animation. There are also some special effects thrown in which enhance the rather thin story line.



The Story

The story is about a little boy named Hubert who goes out one day to discover the world being drained of color. A magical figure appears and takes him to the place where the Prism is kept. The three keys of the Prism have been stolen, Hubert is told, and he has been given the task of going to Yolvsa, the land of monsters, to bring color back to the world.

Hubert goes to Yolvsa and is captured in fairly short order by Grane, the head honcho of the monsters, whose dialogue is faintly reminiscent of Margaret Hamilton in The Wizard of Oz ("Resign yourself, whelp. Although you are an insignificant figure, you may yet furnish an interesting tidbit for my extremely large fangkat. Come my lovely...").

Hubert, who is carrying the Prism, uses its magic powers to snatch the keys away from Grane and to escape. At the last instant before departing Yolvsa, Hubert hurls the keys away to keep them safe from a threatening monster. Hubert soon arrives home, where it has been all a dream, and it remains for us to find the keys.

The major problem with the disk is the thinness of the story line and the overwritten quality of the text. It is a story which I doubt would appeal to children. The writing is unprofessional. Had the children's story been better written, in crisper, less cluttered style, the program would have had the valuable extra dimension of literary merit.

The Storydisk format has real potential which is, unfortunately, not realized in *Prism*. Used creatively, as a vehicle for good children's writing, the Storydisk could become a valuable and powerful tool for promoting literacy with the computer. *Prism*, with its poor writing and lack of user involvement, has no value as a story. It's a good thing that the disk

---

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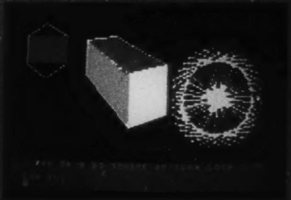

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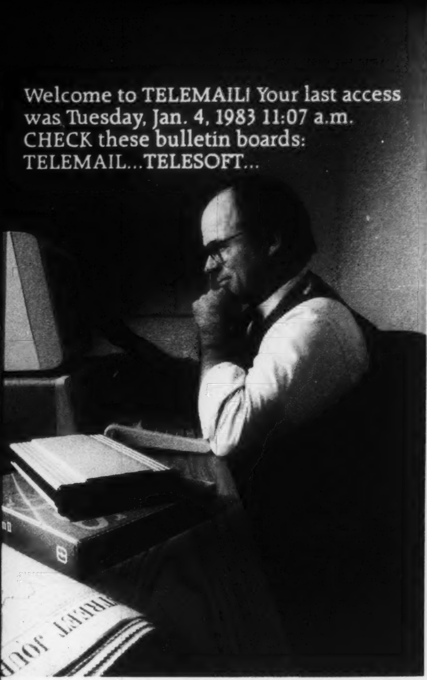
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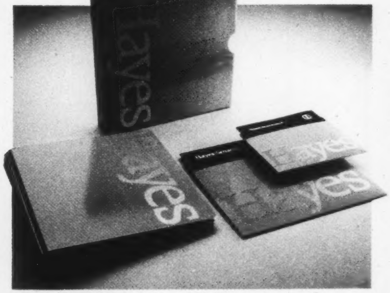

Prism, continued...

doesn't depend on the story, but on the puzzle.

The Puzzle

The idea for the puzzle comes from the British children's book, *Masquerade* by Kit Williams. For those who solved the riddles posed in his book there was the promise of finding a solid gold rabbit which Williams had buried "somewhere in Britain" (incidentally, the rabbit was found and the puzzle has been solved, leaving only *Prism's* golden prizes remaining to be found).

Aside from borrowing this idea from *Masquerade, Prism* also borrows some of the form of the book, if not the content, framing the illustrations with inscriptions. These inscriptions are used in both works to further illustrate the story and to provide clues to the big riddle.

> ***As works of art and collector's items the keys will be worth from $30,000 to $40,000.***

On to the clues! ISM says that the clues could be anywhere on the disk, in the text, the pictures, or the inscriptions. The inscriptions are found to have, at irregular intervals, certain letters drawn in different colors from the majority. For example, in the inscription framing picture number one, "Up north lines meet, down south fates greet," the letters I, M, P, S, R are in orange. Unjumbled, they spell Prism.

Picture number ten is framed by the words, "Excavation excites extreme exhaustion." The letters I, V, X, X, X are colored orange. They don't appear to spell a word, but they could be combined to make two Roman numbers, XXXIV which is 34 and XXXVI which is 36. A clue?

Some of the inscriptions seem to offer number puzzles, again along the lines of Williams's *Masquerade*. For example, in *Masquerade*, there was the riddle, "One of six to eight" in one of the inscriptions. It referred to *one* of Henry the *Eighth's six* wives. Get it? Now let's look at the inscription around *Prism's* picture number five: "Two of one one of two colors red white and blue." What is the clue?

How about the inscription around picture number nine: "In at 7 out at 4 forwards eight and slightly more." What does this mean? Then look at picture four's inscription: "Many are my pretty facets 1 thru 3 of eight." What have we here?

In the pictures, what is the meaning of the trigrams and the hexagram from the Chinese book of prophecy and philosophy, the *I Ching*? In three locations we see the trigram Ken, which symbolizes an arch, a mountain, a path, little stones, or openings, depending on your interpretation. In one picture there is the hexagram number 30, called by the *I Ching* "The Clinging Fire." The hexagram symbolizes resting on something the way plants rest on the soil. Is that a clue, or is the number of the hexagram, 30, more significant?

There are some rather off-beat names in the text. For example, Hubert's dog is named Vanna. As in Savannah, Georgia? What about Grane, the monster king and Yolvsa, the land of monsters? Are these names anagrams? What does the inscription, framing picture eight, mean: "Not a roc, never hot, not fruit, never locked."

If the storyline is thin, the puzzle is far from it. There are clues galore to follow. Some, I suspect, will lead you in the wrong direction. You may also find yourself mistaking parts of inscriptions, text and illustration for clues when they are, in fact, not riddles to be solved at all. That's the charm and challenge of this kind of puzzle, having to sort out the real clues from the superfluous information.

I was unable to wrest any hints from ISM. Are the keys more than one hundred miles apart? Five hundred? No comment. Are the clues in the pictures only, in the pictures and inscriptions, or in the text, pictures and inscriptions? No comment. The only help I got, which I pass on to you, is that the keys are in the 48 contiguous states...somewhere.

If you find them, they will be worth, at this writing, about $15,000 on the basis of their gold and gemstone content. ISM predicts that as works of art and collector's items the keys will be worth from $30,000 to $40,000 and that makes a puzzle worth solving. ☐

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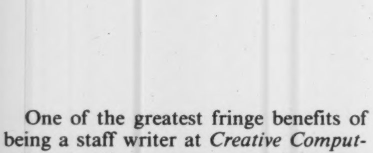
Apple Adventure and Arcade Action

Owen Linzmayer

One of the greatest fringe benefits of being a staff writer at *Creative Computing* is that I get to see most of the new games as they are released. Even though it is my job to review programs, I also spend a great deal of my free time playing my favorite games. Of the new games I "had to" play this month, *Aztec, Jawbreaker,* and *Spy's Demise* are the ones that keep me at my Apple long after hours.

Aztec

To be honest, adventure games have never really appealed to me. Wandering helplessly through screens full of text is not my idea of fun. Therefore, I was less than enthusiastic when *Aztec* appeared on my desk for review. Reluctantly, I booted the program and prepared to be bored. It wasn't long, however, before I realized that *Aztec* is like no other adventure game I have ever seen. I love it.



What sets *Aztec* apart from most of the other adventures currently available for the Apple? It is a real-time game with hi-res animation which allows you to control an explorer using 21 command keys.

As the player, you represent a daring explorer who bears a striking resemblance to Indiana Jones from the movie, *Raiders of The Lost Ark.* Your challenge is to delve into a tomb that is eight levels deep in an attempt to retrieve a priceless golden idol. The chambers and anterooms are literally crawling with death in the form of scorpions, cobras, spiders, and seven other lethal guardians of the idol.

If you encounter a guardian, you may fight it or try to run away. When you enter the "fight mode," you must select the weapon you wish to use. The only weapons available are a machete and a pistol, both of which you must acquire in the tomb. Most guardians can be killed using only the machete, but some monsters can withstand multiple bullet wounds before they die. In general, the fighting controls are similar to those found in *Swashbuckler,* a program written by the same author, Paul Stephenson.

In addition to the guardians, there is a wide variety of traps designed to stop you as you weave your way into the depths of the temple. If you aren't careful, you will quickly find yourself dead. Some of the more clever traps include

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SOFTWARE PROFILE

Name: Aztec

Type: Animated adventure

System: 48K Apple II/II+

Format: Disk

Language: Assembly

Summary: Action-packed, innovative game

Price: $39.95

Manufacturer:
Datamost Inc.
9748 Cozycroft Ave.
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EASE-OF-USE By dividing programs into modules, JRT Pascal makes even very complex programs—of nearly any size—a breeze to manage. Pascal code is *self-documenting;* program sections are identified by meaningful names, not line numbers. Error messages are verbal, not number codes. JRT offers *12 data types* (to Basic's 2 or 3), and it has both regular and hex numbers.

POWER For power—the ability to write better, clearer programs, faster—Pascal is the run-away winner. Example: JRT simplifies programming by accomplishing complicated operations (for Basic) with one command:

```
Basic                  JRT Pascal
IF A$ = "V" OR         IF A IN ['V'..'Z'] THEN...
   A$ = "W" OR
   A$ = "X" OR
   A$ = "Y" OR
   A$ = "Z" THEN...
```

FLEXIBILITY JRT's wide variety of data types reduces programming restrictions. And the data types are not all fixed in size. There are *3 looping statements* (Basic has 1). With JRT, very large programs can be created and run, because program modules can be spread over many diskettes. Common modules can be used for several programs. Basic generally limits strings to 255 bytes; *JRT strings go up to 64K.*

EFFICIENCY Whereas Basic relies on a static, inefficient memory map to allocate storage, JRT's *dynamic storage* fills every available main storage area; there's no waste. With Basic, sub-routine modules must be linked together; with JRT, they can be linked—but don't have to be. JRT's more powerful commands run faster; typically, you'll *write Pascal programs 3 to 10 times faster* than in Basic. *Exclusive:* JRT lets you directly access the CP/M* operating system for better total system control.

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Data types	Usually 2 or 3	12
CASE statement	No	Yes
Introduced	1965	1980
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rooms that fill with water, ceilings that fall, and walls that slide together. The beauty of these traps is that they can be defeated with a little ingenuity. There is a sense of urgency as you play in real time because you must learn to act fast. Even on the easiest level, *Aztec* is extremely difficult. Too many times you lose a life at the mercy of the program rather than as a result of your own mistakes. This can lead to frustrating play.

The main appeal of this adventure is that it is a real-time, highly animated arcade game that allows the player to exercise an extensive range of options. The graphics are hi-res, but not too colorful. The animation is jumpy, as if the computer is flashing different images in sequence to suggest movement. *Aztec* looks like a cross between *Castle Wolfenstein* and *Swashbuckler.*

Aztec *looks like a cross between* Castle Wolfenstein *and* Swashbuckler.

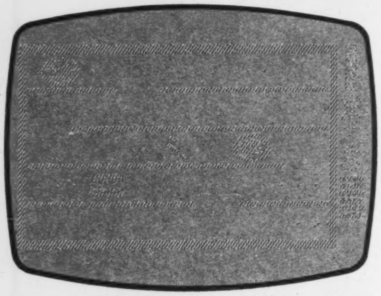
The thing that immediately turns off many prospective players is the large number of command keys. It took me about an hour of practice before I memorized the keys and "mastered" their use. I would wager that this game is nearly impossible to play if you aren't a touch typist.

Although there are a few unpolished edges in the program, *Aztec* is a fine package. If you enjoyed *Swashbuckler,* but felt that it lacked depth, *Aztec* is just what you are looking for. Any adventure player who wants a real challenge will find it in this game. Due to its complexity, I do have reservations about recommending it to kids under 14 or to gameplayers who believe themselves to be hopelessly uncoordinated.

Jawbreaker

You may be asking yourself "Hey, why review *Jawbreaker?* That game has been on the market for close to a year now." Well, that's only partly true. The old *Jawbreaker,* the one that plays like Pac-Man, has undergone a total transformation, and the result is a cute new game that goes by the same name.

The object of *Jawbreaker* is to eat the dots that line the maze. Unlike other mazes, this one is composed of five horizontal corridors laid on top of one another. The hallways are separated by walls that have sliding doors in them. As you play, the doors are constantly moving along the hallways. When a door reaches one edge of the maze, it reverses direction. To pass from one horizontal corridor to an adjacent hallway, you must slip through the sliding door as it goes by. It sounds easy, but the timing is tricky.



As you guide your jaws through the maze, you must avoid the rolling faces. These four guys are the only things keeping you from eating your way to obesity. If you touch a face, you lose a set of teeth. To chomp on the faces, you must first eat one of the energizers that are located in the four corners of the maze.

creative computing

SOFTWARE PROFILE

Name: Jawbreaker

Type: Arcade

System: 48K Apple II/II+ DOS 3.3
48K Atari 400/800

Format: Disk/cassette (Atari only)

Language: Assembly

Summary: Creative new maze game

Price: $29.95

Manufacturer:
Sierra On-line Inc.
36575 Mudge Ranch Rd.
Coarsegold, CA 93614

Jawbreaker can be played by using the keyboard, a joystick, or a joyport controller. If you choose to use the keyboard, you are allowed to define the keys that you want to control the action. The joyport with a switch-type joystick is the most responsive and accurate type of controller for this style game in which precise, four-directional movement is required.

The playscreen is depicted in colorful hi-res graphics. As the faces roam the hallways, they roll, giving the illusion of three dimensions. The best word to describe this game is *cute.* It is simple to play, yet not easily mastered. You don't get the feeling that the faces are out to get you, but rather, that you must simply avoid them. This makes for a very light-hearted atmosphere.

The game can be played at one of ten selectable difficulty levels. The lower the level, the slower everything moves. The default level is fast-paced and provides a challenge to even experienced players. As the game progresses, the faces become more aggressive, and the energizers do not last as long.

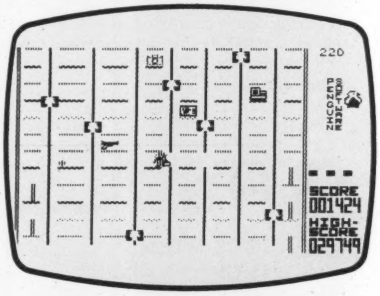
This new version of *Jawbreaker* is written by Charles "Chuckles" Bueche, and it is nothing like the first version. If you are looking for a good variation on the maze game theme, *Jawbreaker* won't let you down.

Spy's Demise

As you sit in the lobby of the Bangkok Hilton, you overhear two Russian KGB agents discussing an encoded message which holds the key to very valuable computer data. Each component of the message is kept on a separate floor of the Russian embassy. There is only one secret agent who can infiltrate the heavily guarded Soviet embassy, and that spy just happens to be you. The mission is yours, whether you decide to accept it or not. Good luck.

The mission is yours, whether you decide to accept it or not. Good luck.

Spy's Demise, written by Alan Zeldin, is a new arcade action game from Penguin Software. You play the role of a trustworthy spy attempting to steal an encoded message out from under the noses of Russian embassy officials.



You are portrayed in detailed hi-res graphics as a trenchcoat-clad figure who shuffles silently about. Scattered on the platforms are various spying tools which contain pieces of the encoded message. As you pass over them, you pick them up, but gain no points.

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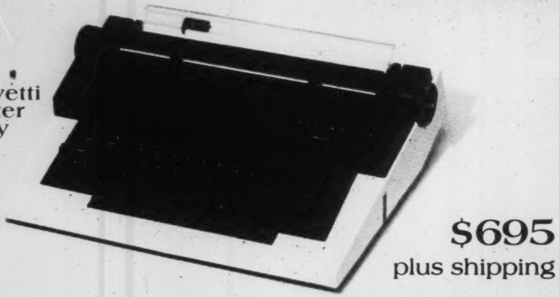

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SOFTWARE PROFILE

Name: Spy's Demise
Type: Arcade action
System: 48K Apple II
Format: Disk
Language: Assembly
Summary: Fast-paced, addictive game
Price: $29.95
Manufacturer:
Penguin Software
830 4th Ave.
Geneva, IL 60134

Basically, *Spy's Demise* is a "chicken" game, much like the popular Activision VCS cartridge, *Freeway.* You must stay out of the predictable paths of the oncoming guard elevators. The thing that sets *Spy's Demise* apart from similar games is the challenge of solving the encoded message. There is a strong incentive to reach each successive embassy floor.

Spy's Demise can be played by only one player at a time. You select what type of controls you prefer to use (paddles, keyboard, or Atari joystick). Moving your man left and right are the only two commands in this game. The thing that makes *Spy's Demise* difficult is that there is no way to stop the movement of your spy, which increases your chances of making a mistake.

There is very little happening in the sound effects department of the game. Each time a new man is introduced into the game, the computer plays a short musical tune. This is as complex as the sound routines get. The suspenseful game play more than makes up for this deficiency, however.

To succeed in reaching the advanced floors, you must have an incredible amount of patience and good timing. As mentioned before, when you climb to the top of a floor, you are shown a portion of the overall message. Each line consists of 16 strange characters. Even if you were able to pass the ninth level, you must still decipher the code to "win" the game. So far, I have seen eight lines of code, but the puzzle remains a mystery to me.

Spy's Demise is full of excitement. It is not a simple action game that relies strictly on dexterity, but rather, a game that requires a blend of coordination and mental ability. From the close shaves with the guard elevators to the thrill of acquiring each piece of code, *Spy's Demise* is a very addictive game. ☐

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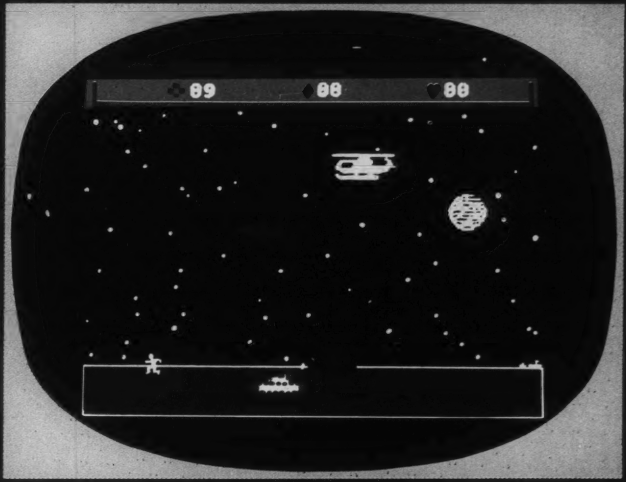

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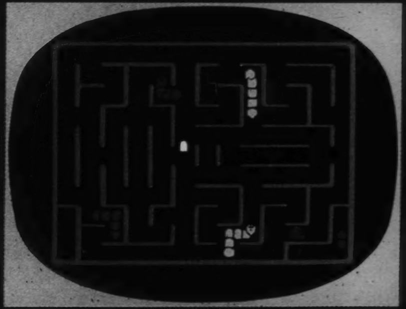

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Landing A Jumbo Atari

Danny Goodman

I thought the best way to test a program titled *747 Landing Simulator* would be to have a real Jumbo Jet pilot grab hold of the joystick and compare the Atari 800 to the Boeing 747. Unable to coerce 747-qualified volunteers, I found two willing guinea pigs who agreed to give it a whirl. Both are experienced co-pilots for major commercial U.S. airlines, one in the right seat of a 737, the other in a 727. Their reactions in a moment.

The *747 Landing Simulator* program, written by William Graham for the Atari 800, was one of the earliest offered through the Atari Program Exchange (APX), a valuable source for low cost Atari software. The program is written in Basic and is available either on cassette (24K RAM required) or disk (32K RAM). All controls are handled by a joystick and the row of numbers on the 800 keyboard.

The object of the simulation is to make a safe landing approach to a runway from 19 miles out at an altitude of 5000 feet. You need to follow the glide path onto the runway while slowing airspeed and making minor course corrections caused, presumably, by cross winds.

The view is out the cockpit window, with your instrument panel in the lower quarter of the screen. The ground is black, and the sky a bluish color, giving you the impression you are landing a little after sundown.

From the blackness of the ground flash runway lights—at first very small in the distance, ultimately filling out the whole area on final approach. The "flashing" of the runway lights is a clever way to allow the computer to update the runway display smoothly even though it does so in Basic, instead of much faster machine language.

While players may be tempted to watch the runway lights, attention should really be focused on the instrument panel. Pilots are provided the following information: altitude in feet, range in feet to midway point of the 10,000 foot long runway, bearing deviation in degrees left or right, airspeed in feet per second, elapsed flight time in seconds, fuel units remaining, bearing and glide slope correction needed, and landing gear up/down. If you wander from the correct course, the letters for the affected instrument (e.g. RANGE) turn from yellow to white.

If you think that's too much to keep an eye on, you're right. Actually, you can forget about the time, fuel and landing gear indicators for most of the flight. But that still leaves an awful lot going on.

Controlling the plane is no picnic either. It takes a great deal of practice to learn the combinations of joystick direction and red button pressing to make the plane react as you want. You have the flexibility to climb and dive at both 50 and 3 feet per second, make turns, climb/dive during turns, drop/raise landing gear, activate autopilot, and abort landing.

Airspeed is controlled by the keyboard numbers, each representing airspeed in hundreds of feet per second. This is the easiest factor to control during landing because there are guidelines to follow in gradually slowing the plane from the starting 900 feet to zero on the runway.

If you don't follow the glide path correctly, several things may happen. The most common is the mid-air collision as your errant path crosses that of a nearby plane. You must be alert to the warning sound of impending danger, then immediately determine corrective action and take it. Otherwise, it's good-bye, Ace. As (if?) you begin the final approach at the foot of the runway (your instrument panel politely indicates when this is), the sweaty palm part really begins. If you don't have enough fuel, or if you descend too quickly, you'll drop to the runway like a stone.

You can't dawdle, either, because you can overshoot the runway before the plane comes to a halt. If, at an earlier stage of the approach, you abort the landing, you see the runway pass below you as you veer away for another try.

A complete landing sequence takes between five and ten minutes, and the closer you get, the more you want to make sure you don't blow it. Successful landings or aborted landings earn scores, based on the difficulty level (instruments, IFR, or visual, VFR), amount of fuel and time used, and whether you invoked the autopilot. The program documentation provides the formula executed in figuring your score.

It took me perhaps 30 attempts before I made my first successful landing—and

creative computing

SOFTWARE PROFILE

Name: 747 Landing Simulator

Type: Entertainment

System: Atari 800 24K (cassette) or 32K (disk), Basic language cartridge, joystick.

Format: Cassette or disk

Language: Basic

Summary: Tougher than the real thing

Price: $17.95 either version

Manufacturer:
The Atari Program Exchange
P.O. Box 427
155 Moffett Park Dr., B-1
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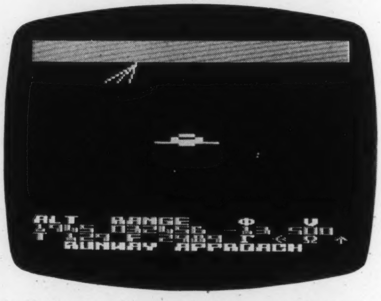
Landing Simulator, continued…

that was with the help of the autopilot and the easy-to-follow strategy suggested for novice pilots in the documentation. Soon after, I graduated to the instrument landing without autopilot, but, again, it took many attempts. A successful visual landing has so far eluded me.

Upon making the first landing, I was rather disappointed. I suppose after working so long to accomplish it, I expected something more dramatic in the cockpit view than just grinding to a halt on the runway. Anything more elaborate, however, would probably have enlarged the program beyond the capacity of the 24K cassette version (a beast of a long program to load as it is).

Also, it seems that any safe landing is hailed on the screen as a PERFECT LANDING, even though some are definitely better than others. There is room, I believe, for a pilot rating system, which would be a more concrete way of tracking your progress and skill. At least it would lead me to try more often to reach higher rating levels and refine my technique.



But, as I learned from my pilot friends, it ain't like the real thing. We surmised that the association with the 747 was an intelligent way of disguising the slowness of the Basic program. Apparently, the hydraulic system of a 747 is slower to react to cockpit controls than those of smaller jets.

The instrument configurations of the simulator were not what the pilots expected, especially the bearing and glide slope indicators. The computer version was more difficult for them to interpret. Thus, the pilots will probably not like this program, but those who don't know any better will find it a mental challenge.

As it turned out, neither professional made it to the runway, after a combined effort of about 20 approaches. Practically all ended as mid-air collisions. One pilot turned in his computerized wings saying that if flying real jets was as difficult as this, he would never have become a pilot. And, after seeing these pros demolish plane after plane, next time I'm taking the train. ☐

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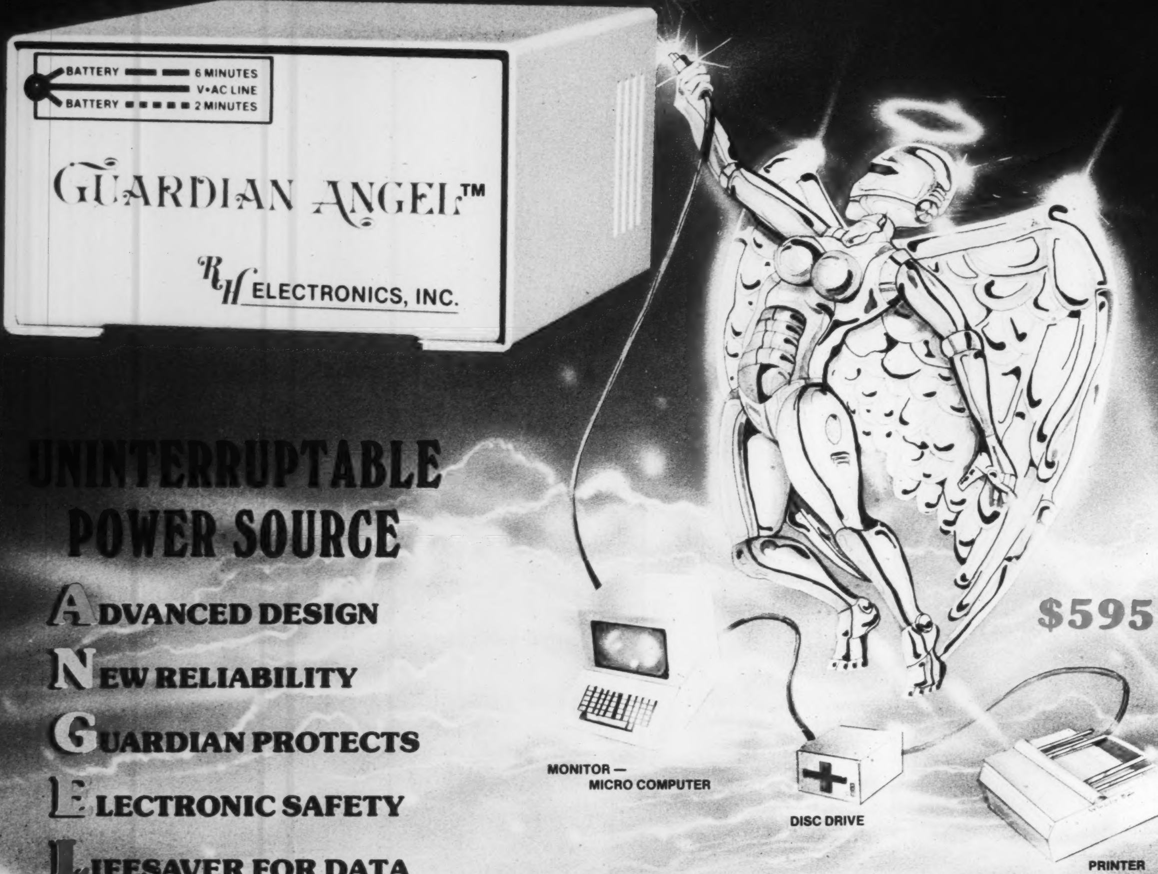

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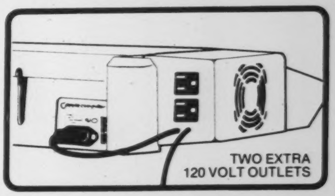

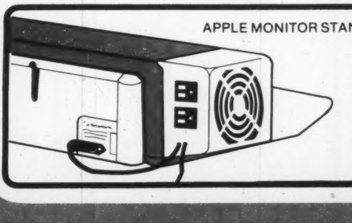

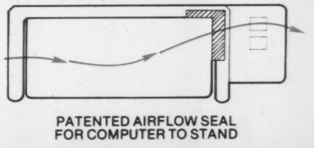

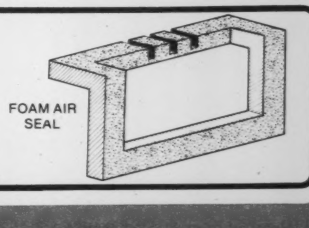

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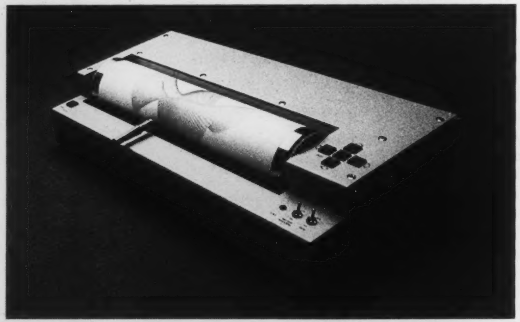

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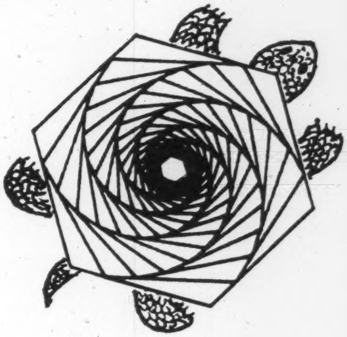
CIRCLE 282 ON READER SERVICE CARD



Logo Ideas

Robert Lawler

Re-solving Problems

Some problems you want to put behind you—like having to do what you don't want to do, and not being able to do what you do want. Such problems should be resolved. Other kinds of problems have a friendlier face, and certain of them are worth solving and re-solving. Think about making a circle. Doing so is a classic Logo problem for beginners. Novice learners are typically asked to "do-it-yourself," to walk through the problem by simulating the turtle. Their typical explanation of what they are doing as they walk in a circle is that they go forward a little and turn a little and do it again. This explanation translates directly into the Logo circle:

```
TO CIRCLE
FORWARD 1
RIGHT 1
CIRCLE
END
```

The Logo circle is very easy to make with a Logo computer, but it would be difficult to make such a circle by drawing on a piece of paper. The Logo circle is very perimeter-focussed because the turtle knows nothing at all about "centers." (This leads to some interesting bugs and problems in turtle geometry procedures.) The Logo circle is natural in the sense that it is the path of an activity as familiar as walking is.

In plane geometry if you ask, "What's a circle?" the object, "the locus of all points in a plane equidistant from another point," is easy to construct with a compass and not even hard to construct without one. The Euclidean circle is as "natural" as the Logo circle in the following sense: imagine a person sitting; the figure traced by the farthest reach of his arms is as circular as the path followed by any person imitating the Logo turtle. The Euclidean circle is center-focussed, and the circle is the boundary of the center's territory.

Can you get a computer to draw a Euclidean circle? There are several ways. If your computer speaks "polar," you can specify the definition of a circle with the simplest of equations, radius = constant. Descriptions of circles in polar coordinates are simple, but they get complicated quickly if located away from the coordinate system origin.

While the description of a circle in polar coordinates still keeps in mind the relation of the circle to its center, and to a process a person could use unaided to make a circle, the description of a circle in a system of Cartesian coordinates becomes remote from the process of generating a circle:

$$X^2 + Y^2 = C^2$$

This algebraic equation for an origin-centered circle (of radius C) specifies that the circle is the set of all point pairs (X,Y) in a Cartesian coordinate system which satisfy the equation. The primary relationship between the circle and "something else" is here between the circle and the Cartesian reference frame. This contrasts with the Logo circle (where the primary relation was between the circle and its process of creation) and the Euclidean circle (where the primary relation was between the circle and its center). The Cartesian description of the circle and other curved lines, although central to the development of modern mathematics and science, seems relatively unnatural as compared to the Logo and Euclidean circles because of the extent to which the person is removed from the description of the circle.

Summary

Scientists have recommended re-solving problems through the ages. Descartes recommends that whenever you encounter a new idea, you bring it into comparison with all the other ideas you hold as valuable and try to appreciate their interrelations. Feynman, a famous physicist of our time, relates that his practice as a student was typically one of solving a problem whatever way he could, then, with a worked out solution to guide him, to re-solve that same problem in as many different other formalisms or frames of reference as he could.

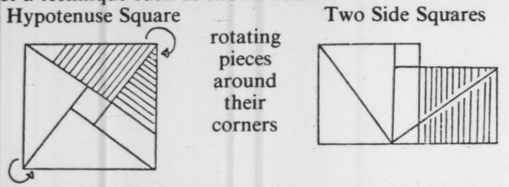
Sometimes You Need Another Idea

One of the most famous problems in the history of ideas puzzled the mathematicians of ancient Greece. They knew how to count very well (even though they used letters of their alphabet to represent numbers). They even knew about fractions, and this is where the puzzle came up. They knew about numbers like 1, and $\frac{1}{2}$ and $\frac{1}{4}$, but they wondered if there were any numbers that couldn't be represented by whole numbers or fractions made from whole numbers. The puzzle became a hot issue for them after the discovery of the Pythagorean theorem. They could prove that the areas of two squares constructed on the edges of a right triangle was equal to the area of a square

---

Robert Lawler, Centre Mondial Informatique Et Resources Humaines, Paris, France.

constructed on the longer line (the hypotenuse), through the use of a technique such as shown below:



This proof helped make the problem more critical because it raised a specific question. If you start with a square one unit long on the side, and make a triangle by drawing the diagonal of the square, the sum of the areas of the two squares constructed on the side will be two units of area; but how long must be the hypotenuse, H, of the triangle made from half a unit square? H must be greater than 1 and less than 2. It must be more than $\frac{4}{5}$ and less than $\frac{3}{2}$.

Greek mathematicians suspected no fraction of whole numbers would result in the number 2 when multiplied by itself, and they began the attempt to prove there was no fraction of whole numbers equal to H. They tried to represent the number H as a fraction of two whole numbers, T (the top number) and B (the bottom number). They knew that H times H had to equal 2 and developed these equations:

$$\text{first, } H \times H = 2$$

$$\text{then, } \frac{T}{B} \times \frac{T}{B} = 2$$

$$\text{or, } \frac{T^2}{B^2} = 2$$

$$\text{finally, } T^2 = 2B^2$$

Having reduced their relation of the possible whole numbers T and B to this simplest form, they were *stuck.* What else is there to do? Where can you go from here with this one idea? Think about it for a while. Can you go on from here?

Another idea is needed, another whole different way of looking at what T and B might be. The trick is to look "inside" T^2 and B^2. What must they be made of? No square can be a prime number (squares are made by multiplying at least two other numbers together). The factors of a square must be two (in number) if the roots are prime or some multiple of two if the roots are not prime, as in the example below:

Square	25	36	64	100
Prime Factors	5x5	(2x3)x(2x3)	(2x2x2)x(2x2x2)	(5x2)x(5x2)
Count of Factors	2	4	6	4

Any number is either a prime number or can be decomposed into prime factors. Therefore every square *must* have an even number of factors. But think back about the equation: $T^2 = 2B^2$. Doesn't that imply there is at least one square, T^2, which must have an *odd* number of factors? It surely does, and therefore it must be wrong. Consequently, there must exist numbers, like the square root of 2, which can not be expressed as the ratio of two whole numbers. That is, irrational numbers exist.

This mathematical proof was a difficult one for men to discover. Then someone realized that a new idea was needed, a new way of looking at the problem. Once a second way of describing the problem was brought to bear, its solution was relatively straightforward, almost obvious. When you have a very difficult problem, maybe you ought to think about whether some other description of the problem could help you with it. Finding the right description isn't always easy; it may, however, be necessary. ☐

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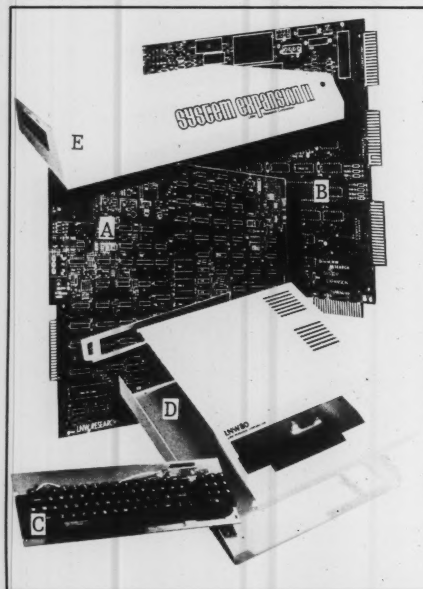

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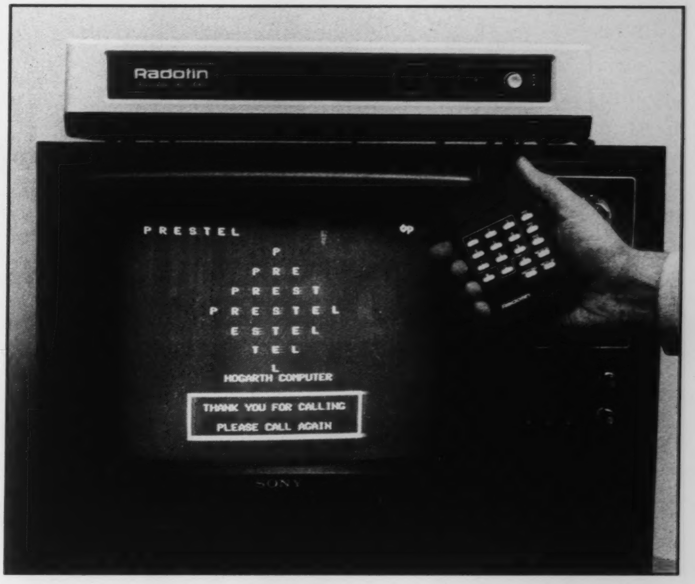
CIRCLE 267 ON READER SERVICE CARD

A User's View Of Prestel



Eric Somers

Prestel *is* viewdata. The British based electronic information utility now known as Prestel was originally named Viewdata (with a capital V). But viewdata quickly became a generic term used to refer to any interactive videotex service, and the premier viewdata service was renamed Prestel.

Prestel is run by the British post office, known as British Telecom, which also runs the telephone system in the U.K. Over 900 organizations contribute information to the 230,000-page Prestel database. Subscribing to Prestel is like taking 900 magazines and getting a high speed international mail service thrown in for good measure.

I even sent an electronic greeting card to Prince Charles and Princess Diana congratulating them on the birth of their son. I received a reply, too. Through several newsletters published on Prestel I keep track of new developments in the videotex industry. Since I am planning a trip to Australia, I used the Prestel advertiser reply service to request travel brochures. The Australian Tourist Commission sent me a packet an inch thick. There is such a wide range of information on Prestel, you might find it hard to think of a topic about which some information provider has not put up pages. Looking for a ferret? You can find information about these unusual pets on Prestel.

I have been a Prestel subscriber for over six months now, but I am still surprised at the volume and variety of information available. That's the excitement. Nearly every time I sign on, I discover a gem of information I did not expect. And some of the information would be hard to obtain elsewhere.

Although many computer users in the U.S. are familiar with electronic

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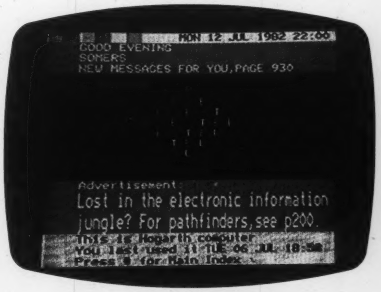
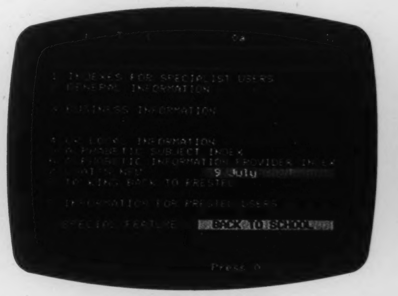
Eric Somers, Department of Communication, University of Wisconsin/Stevens Point, Stevens Point, WI 54481.



Prestel welcome page.

```
MON 12 JUL 1982 22:00
GOOD EVENING
SOMERS
NEW MESSAGES FOR YOU,PAGE 930

Advertisement:
Lost in the electronic information
jungle? For pathfinders,see p200.
This is Hogarth computer
You last used it TUE 06 JUL 18:5
Press 0 for Main Index
```



Prestel main index page.

```
1 INDEXES FOR SPECIALIST USERS
  GENERAL INFORMATION

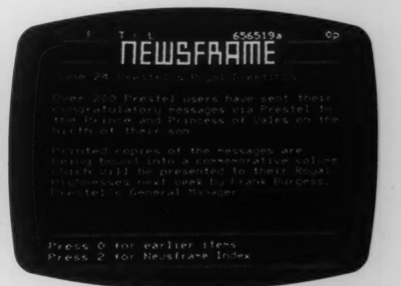
  BUSINESS INFORMATION

  UK LOCAL INFORMATION
  ALPHABETIC SUBJECT INDEX
  ALPHABETIC INFORMATION PROVIDER INDEX
  WHAT'S NEW           9 July
  LOOKING BACK TO PRESTEL

  INFORMATION FOR PRESTEL USERS

  SPECIAL FEATURE      BACK TO SCHOOL

                    Press 0
```



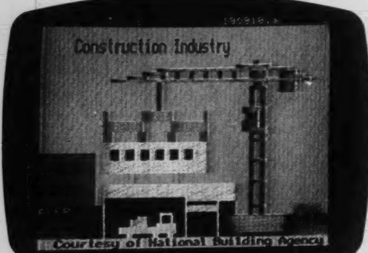
Typical page of textual information.

```
                    656519a     0p
NEWSFRAME
June 24 Prestel's Royal Greetings

Over 200 Prestel users have sent their
congratulatory messages via Prestel to
the Prince and Princess of Wales on the
birth of their son.

Printed copies of the messages are
being bound into a commemorative volume
which will be presented to their Royal
Highnesses next week by Frank Burgess,
Prestel's General Manager.

Press 0 for earlier items
Press 2 for Newsframe Index
```



Picture utilizing Prestel's low resolution graphics capability.

information utilities like The Source and Compuserve, Prestel differs markedly from these services in display format, indexing structure, and database content.

Standardized Page Display

All information on Prestel is designed to be read in pages, or screens, consisting of 24 lines of 40 characters. Both upper- and lowercase alphanumeric characters are supported, as well as two special graphics sets of 64 characters each. All characters can be displayed in any one of seven colors against any one of seven background colors, and can also be displayed in double height or flashing mode.

To use Prestel, you must purchase a special terminal that supports the display protocols, or buy hardware or software products to adapt a personal computer to Prestel. Currently, the Apple II and TRS-80 Model III can be adapted for black and white display simply by running special software. Combination software/hardware packages exist for color adaptation of Apple II, IBM, and S-100 bus personal computers.

Use of a standard display means that there are never awkward line wraparound problems, and important information never scrolls off the top of the screen. All information on Prestel is transmitted as one or more complete pages that are written on the screen from top to bottom.

Although color may not seem important for textual information, many Prestel information providers make excellent use of contrasting colors for emphasis or to lead the eye. And the combination of color, lowercase characters, interesting page layouts, and graphics makes Prestel a true *communications* medium, not simply a database.

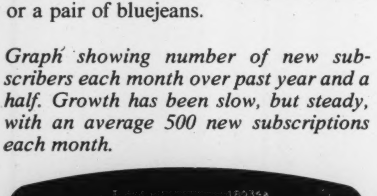
SUPERSTATS Month ending 30.06.82
NUMBER OF SETS IN USE 17,743

"Superstat" page showing current level of utilization. As of June 30, 1982 Prestel had 17,743 subscriber terminals in use. Page also shows number of IPs and Sub-IPs, total number of pages in use, and a McDonald's hamburger total of individual page accesses since beginning of service.

As a former advertising agency creative director, I may be especially sensitive to the visual design capabilities of Prestel, but when I give demonstrations of both The Source and Prestel to my university classes, the students overwhelmingly favor the visually more exciting Prestel display. To a generation brought up on mass media and video games, it is not enough that computers provide information, the method of presentation must be as design oriented as a new arcade fad, a slick publication, or a pair of bluejeans.

Many Prestel information providers make excellent use of contrasting colors for emphasis.

Graph showing number of new subscribers each month over past year and a half. Growth has been slow, but steady, with an average 500 new subscriptions each month.



Menu Driven Access Structure

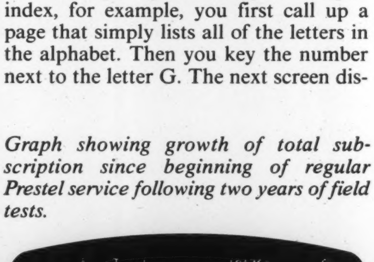
The model for Prestel information retrieval is print. It is a library of regularly updated periodical information. Indexes are used to find specific information. By keying numbers next to index entries, you can quickly move through more and more specific index layers to the information you seek. Numerical labeling of menu choices allows Prestel to be accessed with a simple numeric keypad. This speeds up menu selection and allows one to sit back in an easy chair with a keypad smaller than most TV remote controls.

If menus seem like a slow way to retrieve information, remember that Prestel is designed to be received at 1200 bits per second (bps) and that an extremely efficient operating system assures a consistent response time of less than *two seconds* from the time a key is pressed until the page begins to appear. The response is so instantaneous that some people who have used my terminal can hardly believe they are online to a computer in the U.K.

Since all Prestel pages are numbered, once you have used an index to locate specific information, you can repeatedly go back to selected pages with a direct call to the individual page numbers. This ability to jump from any part of the Prestel database to any other part in less than two seconds is an invaluable time saver. Though competitors sometimes criticize Prestel for a lack of keyword search capability (a time-consuming disk-intensive feature), using indexed and numbered pages is far more natural and convenient for most people.

The most general indexes on Prestel are alphabetic indexes by subject matter and by name of information provider. To locate gold prices using the subject index, for example, you first call up a page that simply lists all of the letters in the alphabet. Then you key the number next to the letter G. The next screen dis-

Graph showing growth of total subscription since beginning of regular Prestel service following two years of field tests.



NOBODY EVER PLAYS JUST ONE HAND OF STRIP POKER.

There's no such thing as a quick game of *Strip Poker.* With two captivating female opponents, this fast-paced program features graphics and game play so realistic that players tend to lose track of time. Decorum forbids that we actually show you what happens on the screen. Suffice it to say that our sophisticated software gives you ample incentive to stretch your poker skills to the limit!

Just to sweeten the pot, we've added two new data disks . . . one with two new female opponents, the other with two males. The action is intense and the stakes are high.

If you have a keen competitive instinct and don't mind occasionally losing your shirt, see your local computer store or call us for *Strip Poker* today.

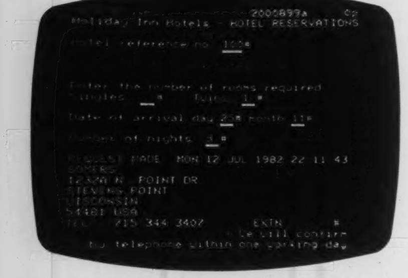
Atari (40K) and Apple II (48K) computers, $34.95 Diskette. Additional Data Disks (specify male or female) $24.95 ea.

Look for these and other Artworx programs at your local computer store. For a free catalog, write or call 800-828-6573. Artworx Software Co., Inc., 150 North Main St., Fairport, NY 14450 (716) 425-2833

Artworx™

So you can play.

Apple and Atari are registered trademarks.



```
                        2000899a    0p
Holiday Inn Hotels - HOTEL RESERVATIONS

Hotel reference no 100#

Enter the number of rooms required
Singles  _#    Twins 1_#

Date of arrival day 25# month 11#

Number of nights 3_#

REQUEST MADE  MON 12 JUL 1982 22 11 43
SOMERS
1232A N  POINT DR
STEVENS POINT
WISCONSIN
54481 USA
TEL  715 344 3407        EXTN       #
                       We will confirm
   by telephone within one working day
```

Example of Prestel response page, in this case used by Holiday Inn for taking reservations.

plays subsets of character strings starting with G (e.g., Gab-Gam, Gar-Ger, etc.). Keying the number adjacent to Go produces a new menu page showing a series of words starting with Go . . . Keying the number for Gold accesses a menu listing all of the information providers presenting information about gold. Another keystroke takes you directly to the commodity quotation pages.

Although this process usually takes a little over a minute, the number of menu layers can be cut almost in half by using the more specialized Business Information Index to find gold prices. An even more direct Commodities Index can shorten the search time to under 30 seconds. And Prestel has 17 specialist indexes covering such diverse categories as agriculture, auto industry, medicine, microcomputing, shipping, travel industry, and viewdata industry. Since each electronic "publication" on Prestel has its own mini-index of current stories or data; once you have located these individual publications you can go directly to those pages without having to use any of the general indexes.

Up through January 1982, an extensive printed directory of the Prestel database was available on a quarterly basis from the Financial Times (London). They recently discontinued this service, but there are indications from Logica, the U.S. sales representatives for Prestel, that another such publication may soon become available.

The paged structure of Prestel points up its primary mission to be a mass information medium rather than a computer timesharing utility. Prestel is not designed for word processing, managing home finances, or calculating mortgage payments. Some of the information providers have skillfully indexed their material to simulate a timesharing utility. For example, there is a multiple-choice quiz you can take to find out what kind of dog would be the best pet for you. At the end you are presented with a list of suitable breeds. The list may appear to have been computer prepared on the basis of a real time analysis of your answers. In fact, each question with its numbered answers is simply a menu that helps guide you to one of a series of prepared "answer"sheets.

Some time-share utilities will become available on Prestel as information providers gradually make use of newly developed *gateway* software that allows information stored in computers outside the Prestel network to be formatted, in real time, for Prestel display. This will permit bank-at-home services (now being tested) and other utilities requiring processing beyond ordinary page retrieval.

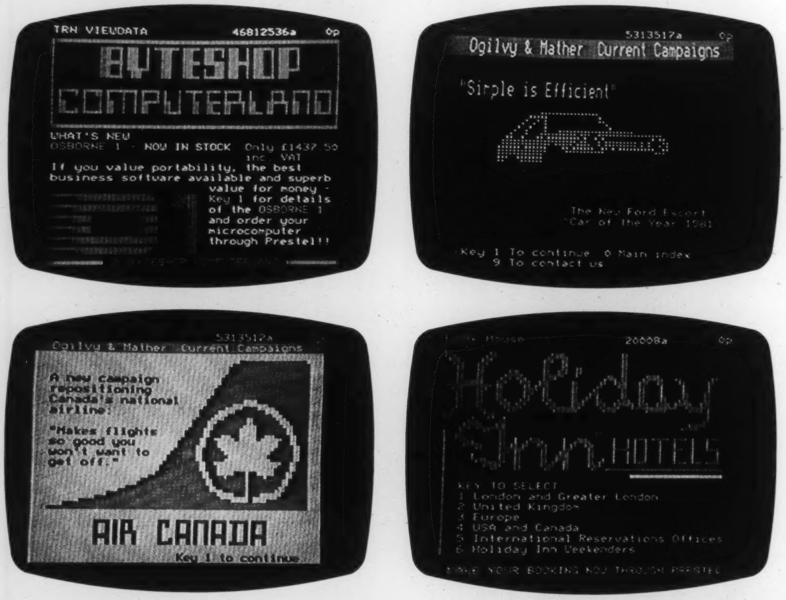
Prestel is not designed for word processing, managing home finances, or calculating mortgage payments.

Prestel supports no bulletin boards or user-entered classified ads. This may be perceived as a defect by some, but it does keep the service from being cluttered with the kind of trivia that has characterized some U.S. electronic bulletin boards. Prestel users can order products using special response pages with multiple choice selection of items to permit ordering with a numeric-only keypad. Users with full alphanumeric keyboards can also send electronic mail to other Prestel subscribers. Since Prestel is currently being accessed in 25 countries, this benefit should not be underrated.

A Publisher's Clearinghouse

An information service is no better than the information it provides. The ultimate benefit of Prestel is its range and quantity of information. This is the result of a two-tiered information provider (IP) structure that makes it attractive for publishers both large and small to use Prestel. Major publishing organizations—either electronic publishing entrepreneurs or traditional publishers seeking new channels—can become full-fledged IPs by paying a yearly $10,000 membership fee and agreeing to rent at least 100 pages. But many of these larger providers broker their pages in smaller lots to Sub-IPs who may only put up a dozen or so pages.

As of this writing there are 169 major IPs and 801 Sub-IPs—a total of 970 publishing organizations in all. When you consider that each of the 970 databases consists of information de-



Advertising pages often utilize color and graphics. Ford Escort graphic shows use of separated *graphics font in which each element within each graphic character is isolated and surrounded by the background color.*

```
TRN VIEWDATA                46812536a    0p
BYTESHOP
COMPUTERLAND
WHAT'S NEW
OSBORNE 1 - NOW IN STOCK  Only £1437.50
                          inc. VAT
If you value portability, the best
business software available and superb
                     value for money -
                     Key 1 for details
                     of the OSBORNE 1
                     and order your
                     microcomputer
                     through Prestel!!
```

```
                          5313517a    0p
 Ogilvy & Mather  Current Campaigns

"Sirple is Efficient"

                   The New Ford Escort
                  "Car of the Year 1981

Key 1 To continue  0 Main index
     9 To contact us
```

```
                     5313512a
Ogilvy & Mather  Current Campaigns

A new campaign
repositioning
Canada's national
airline:

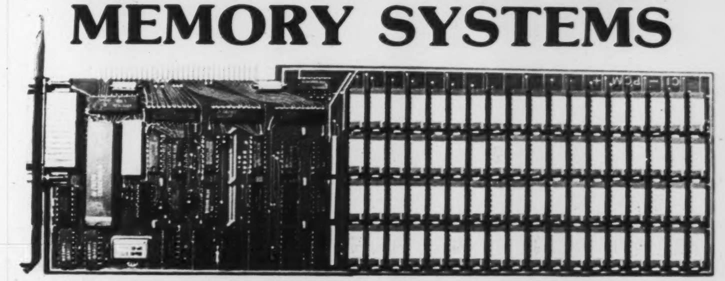
"Makes flights
so good you
won't want to
get off."

        AIR CANADA
                  Key 1 to continue
```

```
                          20008a     0p
Holiday
Inn HOTELS
KEY TO SELECT
1 London and Greater London
2 United Kingdom
3 Europe
4 USA and Canada
5 International Reservations Offices
6 Holiday Inn Weekenders
MAKE YOUR BOOKING NOW THROUGH PRESTEL
```

NEW UP TO 2MB ON A SINGLE CARD!

STATE OF THE ART MEMORY SYSTEMS

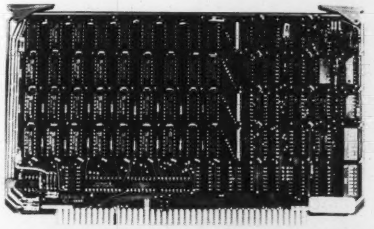


512KB SINGLE BOARD IBM MEMORY W/RS232-C PORT

- Addressable as a contiguous block in 64KB increments thru 1 megabyte.
- On board parity with interrupt on parity error.

SINGLE QTY. PRICE: $795.00

MEMDISK 1 Allows memory to emulate disks. Increases system performance!! FREE with purchase of memory.

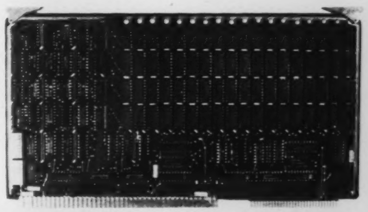


64KB SINGLE BOARD EXORCISER I, II, AND ROCKWELL SYSTEMS 65 MEMORY

- Parity checker on board.
- Addressable as a contiguous block in 4K increments with respect to VXA or VUA.
- Pin to Pin compatibility.

SINGLE QTY. PRICE: $250.00

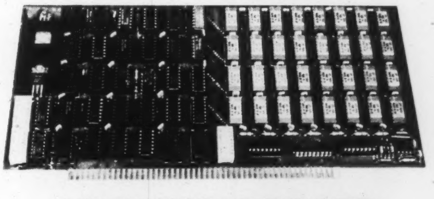
NEW



512MB TO 2MB SINGLE BOARD MULTIBUS MEMORY

- Pin to Pin MULTIBUS compatibility for both 8 bit and 16 bit systems.
- On board parity with selectable interrupt on parity ERROR.
- Addressable up to 16 megabytes.

SINGLE QTY. PRICE:	**512KB**	**$ 895.00**
	1MB	**$4495.00**
	2MB	**$8700.00**

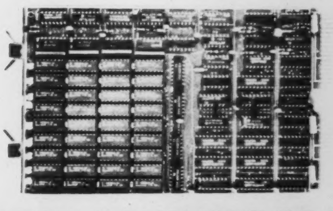


64KB SINGLE BOARD S100 MEMORY

- Addressable as a contiguous block in 4K word increments.
- Battery back-up capability.
- Functions with on-board refresh.

SINGLE QTY. PRICE: $250.00

NEW



256KB TO 1 MB SINGLE BOARD LSI 11 MEMORY

- On board parity generator checker.
- Addressable as contiguous block in 256KB increments through 4 megabytes.
- Battery back-up mode.

SINGLE QTY. PRICE:	**256KB**	**$ 595.00**
	512KB	**$2650.00**
	1MB	**$3995.00**

DON'T ASK WHY WE CHARGE SO LITTLE, ASK WHY THEY CHARGE SO MUCH.

Chrislin Industries, Inc.

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TWX 910-494-1253 (CHRISLIN WKVG)

CIRCLE 136 ON READER SERVICE CARD

signed specifically for videotex display using color and graphics, the uniqueness of Prestel becomes apparent.

U.S. computer information utilities (The Source, Compuserve, and Dow Jones) lack the range of publishers and topics, not to mention the display capabilities, of Prestel. Competing viewdata systems having even greater graphics capability—Canada's Telidon and France's Antiope, for example—have yet to put up any kind of substantial database, much less offer their services in the U.S. Lest the Prestel user fear the low-resolution character graphics of Prestel are too limiting for sophisticated "office of the future" applications, it should be noted that Prestel plans to offer a series of tiered graphics enhancements in the future, including full photographic image transmission.

Sources Of Prestel Related Products

Logica, Inc. 666 Third Ave. New York, NY 10017 (212) 599-0828	Sales agents for Prestel in the U.S. Distributors of Owl Computer Appletel software products and color board for the Apple II, terminal software of their own design for the TRS-80 Model III, and Sony terminals.
Ericsson Programatic 301 Route 17 North Rutherford, NJ 07070 (201) 933-2111	Makers of CCITT V.23 standard modems FCC certified for use on U.S. phone lines, and Prestel adapter boards for the Apple II.
Metrotech Dynabyte Waterloo Rd. Uxbridge, Middlesex UB8-2YW England	Makers of Prestel compatible display boards for S-100 computers.
Modular Computer Systems P.O. Box 6099 1650 West McNab Rd. Fort Lauderdale, FL 33310 (305) 974-1380	Distributors of Bishopsgate terminals in the U.S.
Radofin Electronics (USA) Ltd. 887 Oak Grove Ave. Menlo Park, CA 94025 (415) 326-9715	Makers of Radofin terminals (with built-in V.23 modem) and accessories.
Wolfdata P.O. Box 31 Ithaca, NY 14850 (607) 273-8666	Makers of stand-alone Prestel terminals and Prestel adapters for the IBM Personal Computer.
Zenith Radio Corp. 1000 Milwaukee Ave. Glenview, IL 60025 (312) 391-8181	Makers of stand-alone terminals for Prestel.

My enthusiasm for the Prestel service is tempered by one grim reality: the cost.

Priced for Business

My enthusiasm for the Prestel service is tempered by one grim reality: the cost. Prestel is being marketed as a *business* information service. It was not always so. When Prestel was field tested in the U.K. (starting in 1977), it was intended to be an electronic newspaper for the masses. The 24 x 40 display was selected because it was the maximum resolution that could be displayed on a home TV receiver using a modulated RF output from the terminal. But when Prestel was offered to the British public, at a price much lower than that now charged in the U.S., most citizens still deemed it too expensive to replace (or augment) the family newspaper.

Although one can still find some games and recreational information on Prestel, 87 percent of the present Prestel users are businesses. All U.S. marketing efforts, which began in January 1982, have positioned the service as a business utility carrying a business price tag.

There are three types of charges on Prestel. The first is a $50 per month membership fee. This is not a minimum use charge, but a flat fee added to all time and page charges. Second, there is a charge for connect time: 30 cents a minute if you don't use Telenet (you must call a Boston area number) or 45 cents a minute if you access Prestel through Telenet. This rate applies any time of day or night, 300 or 1200 bps. Still a third charge is the frame charge. Some information providers charge you to read their pages. If you access these pages from a menu page, you will be told the charges before you call up a page. These charges can run from ½p. to 50p. per page British currency (about one cent to one dollar, U.S.). The average charge is usually in the 5p. to 10p. (10-20 cent) range. The vast majority of pages on Prestel are free, however, and in my own experience I find that frame charges are a negligible part of my otherwise substantial quarterly bill.

Prestel Terminals

Prestel can be accessed in the U.S. using any one of three data modem standards: Bell 212 (or equivalent), Bell 103, and CCITT V.23.

The Bell 212 standard is the most common U.S. 1200 bps standard, but modems for it are expensive. Also, most systems for adapting Prestel to personal computers at 1200 bps require *hardware* additions (beside the modem), and are therefore quite expensive.

Currently, the Apple II, IBM Personal Computer, and most S-100 bus computers can be adapted to access Prestel with a 212 modem. Stand-alone terminals from Zenith, Bishopsgate, Sony and Wolfdata are also available in the U.S. for connection to modems using this full duplex 1200 bps standard. Bell 212 users can reach Prestel directly via a Boston area concentrator, or via Telenet.

Bell 103 service, the widely used 300 bps standard, is available for Prestel via Telenet only. Software programs that make the Apple II (with D.C. Hayes Micromodem) and Radio Shack TRS-80 Model III a Prestel terminal use this standard. Though I find 300 bps a tedious data rate, the low cost of these

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"I built this 16-bit computer and saved money. Learned a lot, too."

Save now by building the Heathkit H-100 yourself. Save later because your computer investment won't become obsolete for many years to come.

Save by building it yourself. You can save hundreds of dollars over assembled prices when you choose the new H-100 16-Bit/8-Bit Computer Kit – money you can use to buy the peripherals and software of your choice.

H-100 SERIES COMPUTER SPECIFICATIONS:

USER MEMORY:
128K-768K bytes*

MICROPROCESSORS:
16-bit: 8088
8-bit: 8085

DISK STORAGE:
Built-in standard
5.25" disk drive,
320K bytes/disk

KEYBOARD:
Typewriter-style,
108 keys, 13
function keys,
18-key numeric pad

GRAPHICS:
Always in graphics mode.
640h/225v resolution;
up to eight colors
are available**

COMMUNICATIONS:
Two RS-232C Serial
Interface Ports and
one parallel port

DIAGNOSTICS:
Memory self-test
on power-up

AVAILABLE SOFTWARE:
Z-DOS (MS-DOS)
CP/M-85
Z-BASIC Language
Microsoft BASIC
Multiplan
SuperCalc
WordStar
MailMerge
Data Base
Manager
Most
standard
8-bit CP/M
Software

*128K bytes standard.
**Optional.

The H-100 is easy to build – the step-by-step Heathkit manual shows you how. And every step of the way, you have our pledge – "We won't let you fail." Help is as close as your phone, or the nearest Heathkit Electronic Center.*

And what better way to learn state-of-the-art computing techniques than to build the world's only 16-bit 8-bit computer kit? To run today's higher-speed, higher-performance 16-bit software, you need an H-100. It makes a big difference by processing more data faster.

Dual microprocessors for power and compatibility. The H-100 handles both high-performance 16-bit software and most current Heath/Zenith 8-bit software.

Want room to grow? The H-100's standard 128K byte Random Access Memory complement can be expanded to 768K bytes – compared to a 64K standard for many desktop computers.

And the industry-standard S-100 card slots support memory expansion and additional peripheral devices, increasing future upgradability of the H-100.

High-capacity disk storage, too. The H-100's 5.25" floppy disk drive can store 320K bytes on a single disk. The computer also supports an optional second 5.25" and external 8" floppy disk drives. And an optional internal Winchester disk drive will be available soon.

For more information, circle the reader service number below. Better yet, visit your Heathkit Electronic Center for a demonstration!

The H-100 gives me the most for my computer dollar!

CP-217

Heathkit
Heath
Company

*Heathkit Electronic Centers are units of Veritechnology Electronics Corporation
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CIRCLE 187 ON READER SERVICE CARD

Your greatest challenge lies ahead and downwards.
ZORK I
INFOCOM
The next step downward to danger.
ZORK II
INFOCOM
It all comes down to this.
ZORK III
INFOCOM
A LOCKED DOOR. A DEAD MAN.
And 12 Hours to solve the murder.
DOCUMENTARY EVIDENCE
DEADLINE
STARCROSS

WE'RE WRITING

THEM AS FAST AS WE CAN!

At the rate we're going, we'll have these pages filled by 2083. And by 2084, people will be clamoring for the next Infocom creation.

We hate to disappoint our public. So we keep you waiting. Because while the software factories are cranking out arcade game after arcade game, pulpy adventure after trite fantasy, we're writing and rewriting, honing and perfecting. Before a single person enters one of Infocom's worlds, it must be crafted into a living, riveting, definitive experience.

Judging from the public's reaction, it's worth the wait. For instance, *Creative Computing* welcomed DEADLINE™ as "thoroughly engrossing and realistic," while a *Softalk* readers' poll recently voted ZORK™ I and ZORK II the most popular adventures of 1981.

And now, for the moment, your wait is over. ZORK III, your final step in the underground trilogy, and STARCROSS,™ an exploration of a new dimension in science fiction, are ready for you.

Look at them up there, the little worlds of Infocom. As our universe expands, companions will come to help fill that vast expanse of white space. Till then, they'll continue to stand alone as the best of all possible worlds.

INFOCOM™
55 Wheeler Street, Cambridge, MA 02138

Infocom's worlds are available for Apple,® Atari,® IBM, TRS-80,® Commodore, NEC, Osborne, CP/M,® and DEC.™

Apple is a registered trademark of Apple Computer, Inc. Atari is a registered trademark of Atari, Inc. TRS-80 is a registered trademark of Tandy Corporation. CP/M is a registered trademark of Digital Research, Inc. DEC is a trademark of Digital Equipment Corporation.

Prestel, continued...

programs, $85 and $50 respectively, may make them attractive for some users.

In Europe, Prestel communication uses the CCITT V.23 format, an asymmetrical system in which the pages are transmitted *to* the user at 1200 bps, but typed responses *from* the user are received at only 75 bps (still a fast typing speed). This standard is available for Prestel in the U.S. by direct dialing the U.S. data concentrator ports. Telenet does not currently support V.23 modems.

Although I began using Prestel with the Appletel software for my Apple II, I quickly switched to a very low cost terminal from Radofin Electronics. This remarkable device includes a *built-in* V.23 modem and memory autodialing. It produces a modulated RF video output, so it can be connected to any color TV set.

The color saturation and character sharpness are superior to that produced by any other video RF system I have seen. All color photographs of Prestel screens accompanying this article were made using the Radofin connected to a Sony TV set.

The Radofin terminal has a cassette port for permanent storage of pages. Options include a low cost printer and an alphanumeric keyboard. The list price of the basic Radofin (without options) is around $500 (the firm seems indefinite about exact single unit pricing). It is rumored that another low cost Prestel adapter (terminal plus internal V.23 modem) may soon be available in the U.S. and carry a $200-$300 price tag. This competition may ultimately bring down the cost of the Radofin.

It is rumored that another low cost Prestel adapter may soon be available in the U.S.

Here Today

Most industry analysts agree that neither Prestel, nor any other viewdata service, is about to take the world by storm in the immediate future. But many new communications technologies have had to endure a slow acceptance before realizing sudden growth. Cable television, FM radio, and color television come to mind. All took over a decade, in some cases over two decades, to become popular. Although an impressive service, Prestel is not yet the comprehensive office-of-the-future information/communication system envisioned by futurists. By future standards, I am sure it will appear crude, just as early telephone service seems crude compared to today's multi-function phone systems.

But Prestel is the most comprehensive videotex information service presently available in the United States (or anywhere else). Its display standards can be implemented at low cost and are probably satisfactory for many business applications. The recent announcement by IBM of their own videotex system supporting a Prestel compatible display format may well mean that we will soon see many other Prestel-like services coming on the scene. A de facto standard based on Prestel may emerge before AT&T manages to develop a service based on its much publicized, and expensive to implement, presentation level protocols. And since Prestel already has the lead in quality of service and range of information available from any electronic publishing service, it just might be that with continued research and development supported by the British government, the enhanced information system of the future might also be called Prestel. ☐

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Business • Educational • Graphics
Games • Music • Science
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Library disks 1, 2 & 3 are mixed categories and new disks 4 (Games), 5 (Utilities), 6 (Graphics) & 7 (Integer) at $59.95 each. Why pay more?

Order direct from this ad and $ave up to $136. Buy disk library package 1, 2 & 3 and get a special bonus disk **FREE** — over **260** programs for $179.95 + shipping. For best value, get all 8 disks for $349, postage prepaid, for over **530** of our best programs at 65¢ each!
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36-pin flat interface cable for Epson and Centronics printers. 4-ft. CCAP4P (male to male) or 4-ft. CCAP4S (male to female) Sug. Ret: **$29.80**
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OR SEND the name of your computer dealer if he does not carry the Scooter™ High Grade Electronic Component line . . .

WITH THIS COUPON and your name, address and T-shirt size to: **OHM/ELECTRONICS, 746 VERMONT ST., PALATINE, IL 60067** CC0583

CIRCLE 231 ON READER SERVICE CARD

What the home computer was really meant for.

YOUR HOME COMPUTER IS JUST THE BEGINNING.

You've got your home finances organized, learned a little French, played a lot of Zork. You have all the software you want.

Yet, something is missing.

Introducing Delphi™. The information, communications and entertainment system that takes you far beyond the limitations of disks and cartridges. The system that's so friendly the whole family can use and enjoy it.

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How To Solve It — With The Computer

Electronic Geoboard

Part 1

Donald T. Piele

I saw a geoboard for the first time in 1968 as a graduate student in mathematics. The circumstances were a bit unusual. I had volunteered, through a program called SEED, (Special Elementary Education for the Disadvantaged), to help a class of elementary school kids in San Diego discover modern mathematical ideas—"the new math." Project SEED was a statewide program that grew out of the work that William Johntz had begun in Berkeley, CA. Graduate students in mathematics volunteered for the project, which, in effect, was a substitute for their duties as college teaching assistants.

Instead of helping college freshmen with their calculus, SEED volunteers went into elementary schools and investigated mathematical ideas using the "discovery" method. We were free to investigate any topic in mathematics, since our daily classes were intended to enrich rather than substitute for the regular elementary mathematics curriculum. It was in this setting that I first discovered the geoboard.

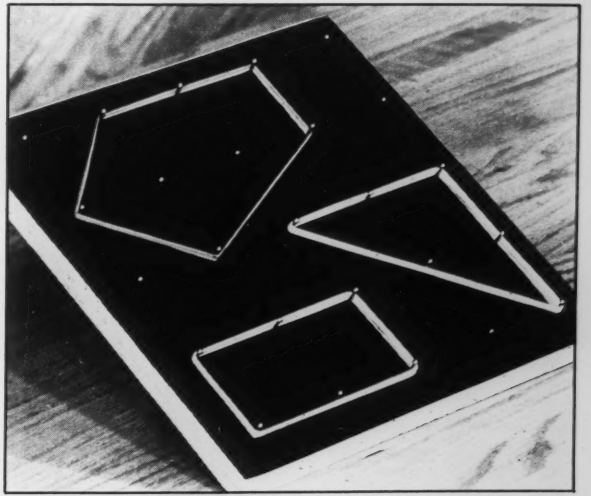
All it takes to make a geoboard is a small square piece of wood, 25 nails, and a hammer. Draw five equally spaced vertical lines and five equally spaced horizontal lines. Hammer a nail at each of the 25 intersection points and, you have a geoboard. To use it, however, you need one other item—rubber bands.

What For?

You probably will not find geoboards in many elementary schools today. They are not an essential tool in everyday life, and I doubt that a movement will spring up to push for "geoboard literacy." But their use in an elementary school classroom has some similarities with the way computers are used today to encourage creative problem solving.

Like a computer, a geoboard is an interactive tool. Students use rubber bands and stretch them around pegs to form polygons of different shapes and sizes. Like a computer, a geoboard does nothing on its own, and, without problems, it is a useless piece of hardware. We used it in our classroom investigations as a "visithink" device and posed "what if" types of questions. Books such as Donald Cohen's *Inquiry In Mathematics Via The Geo-Board,* were helpful in suggesting many good problems for investigation.

This month, I would like to resurrect the geoboard and bring it back to life in an electronic form. The activities presented here for the electronic version will be different from typical geoboard activities.



Our first problem will deal with creating an electronic geoboard and simulating simple operations. The programs will be written in a structured format with names given to each procedure. This should make it possible for anyone to follow the logic of the programs without having to read code designed for a specific system or written in a specific language. Each procedure will also be worked out in Applesoft Basic. Constructing the programs for other microcomputers with graphics capabilities will be left to the reader.

All of the problems presented in this article are designed for beginning and intermediate programmers and are presented for the purpose of developing computer problem solving skills. I hope that the problem solving spirit of the original geoboard activities will not suffer in the translation.

Electronic Geoboard I

Let's begin with the most basic problem:
Write a program that will display a geoboard.

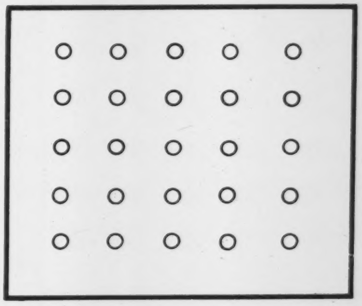


Figure 1. Electronic Geoboard I.

A standard geoboard has 25 pegs arranged in five rows of five columns. It can be drawn graphically as follows:

Donald T. Piele, University of Wisconsin-Parkside, Box 2000, Kenosha, WI 53141.

Procedures — **Applesoft Program**

1. Set graphics mode

```
10 GR
```

2. Set color blue

```
20 BLUE = 2 :
   COLOR = BLUE
```

3. Draw border

```
30 HLIN 0,38 AT 0:
   VLIN 0,38 AT 38:
   HLIN 38,0 AT 38:
   VLIN 38,0 AT 0
```

4. Draw pegs

```
40 FOR I=5 TO 35 STEP 7:
     FOR J=5 TO 35 STEP 7:
       PLOT J,I:
     NEXT J:
   NEXT I
```

The Applesoft program on the right is separated into individual procedures which are given names and listed on the left. The Basic language is not naturally structured, but with a little planning we can at least simulate this quality. Doing so not only helps us read our own programs, it also helps other people translate our programs into a different language.

In the solution to the Electronic Geoboard I, each procedure is carried out in sequential order. In more difficult problems, the same procedure may be needed over and over again. Using Basic, which is not designed to encourage programmers to name and recall procedures by name, we must rewrite the procedure every time we use it, or use confusing branching techniques with dangerous GOTOs.

The only alternative is to construct subroutines. Let's see how the above program would look if we decided to build subroutines first, and then use them to build the program.

To simulate a procedure in Basic using a subroutine, we need to add a RETURN statement to the end of each of the routines already constructed. For example, the procedure SET COLOR in the above program can be modified into an Applesoft subroutine as follows:

Procedure — **Applesoft Equivalent**

2. Set Color Blue

```
20 BLUE = 2:
COLOR = BLUE: RETURN
```

Thus, one way to build a structured solution to the Electronic Geoboard I is as follows:

Procedures — **Applesoft Program**

```
1 GOTO 100
```

1. Set Graphics mode

```
10 GR:RETURN
```

2. Set color blue

```
20 BLUE = 15:
   COLOR = BLUE : RETURN
```

3. Draw border

```
30 HLIN 0,38 AT 0:
   VLIN 0,38 AT 38:
   HLIN 38,0 AT 38:
   VLIN 38,0 AT 0: RETURN
```

4. Draw pegs

```
40 FOR I=5 TO 35 STEP 7:
     FOR J=5 TO 35 STEP 7:
       PLOT J,I:
     NEXT J:
   NEXT I: RETURN
```

* Main Program *

```
100 REM *** MAIN PROGRAM ***
```

Set graphics mode

```
110 GOSUB 10
```

Set color blue

```
120 GOSUB 20
```

Draw border

```
130 GOSUB 30
```

Draw pegs

```
140 GOSUB 40
```

End

```
200 END
```

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Notice that the first statement in line 1 instructs the program to jump over the subroutines and begin the main program at line 100. It may appear to beginners that all we have done is take an easy problem and make it hard. Indeed, that is true if this is the only program about geoboards that one intends to write. But, by employing subroutines to define procedures, it is much easier for the reader to understand what was done. Let's see how this works with the next problem.

Electronic Geoboard II

Write a program that will choose pegs on a geoboard by allowing the user to input a row number and a column number and then change the corresponding peg to a different color.

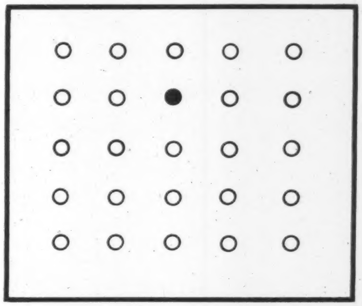

Figure 2. Electronic Geoboard II.

Since we have already constructed the board in the previous problem, we need only add the ability to identify the pegs. Where are the pegs located on the low-resolution graphics screen?

Problem Solving Strategy

Examine the procedure DRAW PEGS. Notice that in the top row the pegs are placed at the following positions:

Row, Column	1,1	1,2	1,3	1,4	1,5
Screen Position (Y,X)	5,5	5,12	5,19	5,26	5,33

Look at the pattern of screen position numbers. How do they relate to the ROW and COLUMN numbers? Did you discover the following relationships?

$$X = COLUMN * 7 - 2$$

$$Y = ROW * 7 - 2.$$

It is a simple matter to extend the previous program to ask the user to identify a row and column from 1 to 5, plot each identified point white, and continue this process as long as the user enters a (ROW,COLUMN) between (1,1) and (5,5). As soon as a point is entered outside of this range, terminate the program. To implement this change, it is sufficient to create three additional procedures and attach them to the previous program.

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Electronic Geoboard II

```
Procedures                  Applesoft Program
1. - 4. Same as in I        .....................

5. Set color white           50 WHITE = 15:
                                COLOR = WHITE : RETURN

6. Choose peg                60 PRINT "CHOOSE A PEG ON THE BOARD"
(range =1,1 to 5,5           61 PRINT "BY ENTERING A ROW,COLUMN"
Point = row, column          62 PRINT "BETWEEN 1,1 AND 5,5"
Read a point                 63 INPUT ROW,COLUMN
                             64 Y=ROW*7-2:
                                X=COLUMN*7-2 :RETURN
7. Check range               70 INRANGE1 = 0
                             71 IF ROW > 0 AND ROW <6 AND
                                COLUMN > 0 AND COLUMN < 6 THEN
                                THEN INRANGE1 = 1
                             72 RETURN
 * Main Program *           100 REM *** MAIN PROGRAM ***
Set graphics mode           110 GOSUB 10
Set color blue              120 GOSUB 20
  Draw border               130 GOSUB 30
  Draw pegs                 140 GOSUB 40
Set color white             150 GOSUB 50
  While peg is in range
    Choose peg              160 GOSUB 60
    Check range             170 GOSUB 70
    Plot peg                180 IF INRANGE1 THEN PLOT X,Y
End                         200 END
```

Notice how much easier it is to read a program if procedures are named.

Let's continue developing the Electronic Geoboard by adding the ability to choose two pegs and shade in the rectangular region that they define.

Electronic Geoboard III

Write a program that asks the user to choose two pegs on the electronic geoboard and then shades in the rectangular region determined by these two pegs. For example, if 2,1 and 5,4 are the two pegs chosen, then the rectangle determined by these pegs is

```
2,1 .  . 2,4
 .  .  .  .
 .  .  .  .
5,1 .  . 5,4.
```

Notice that this same rectangle could also be identified by the two points 2,4 and 5,1.

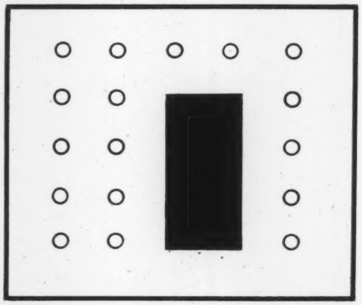

Figure 3. Electronic Geoboard III. Rectangle defined by 2,3 and 5,4.

Problem Solving Strategy

The problem we must first solve is this: Given two pegs, how do we shade in the rectangular region determined by them?

Let's begin by defining how to do this at the procedure level.

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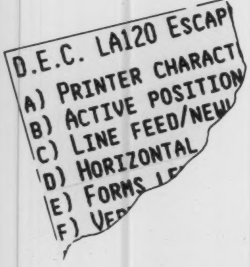

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How To Solve It, continued...

```
            Procedure
          Shade rectangle
        (Peg1 = R1,C1
        Peg2 = R2,C2
        From row R1 to R2
            Draw horizontal line between columns C1 and C2
        Next row)
```

The SHADE RECTANGLE procedure tells us what to do but it does not tell us how to carry it out in a specific language. It is a blueprint that the architect has designed and left to the builder to create. Here are the critical problems that the builder must solve:

- How do row and column numbers relate to screen positions X,Y?
- How do you draw the horizontal lines?
- How do you loop between row R1 and row R2 if R1 is larger that R2?

The first problem was solved in the previous procedure

X = COLUMN * 7 – 2
Y = ROW * 7 – 2.

The second problem can be solved in Applesoft Basic with one simple statement

```
HLIN X1,X2 AT Y
```

The third problem can be solved by adding a direction to the FOR/NEXT loop. If R1 < = R2, then we want to step forward by one row each time we draw a horizontal line. If R1 > R2, then we need to step backward one row each time. The expression (R1 < = R2) - (R1 > R2) does the trick. When R1 < = R2, then the logical expression (R1 < = R2) is true and hence set to 1, while the second term (R1 > R2) is false and is set to 0. If the reverse is true and R1 > R2, then the values are switched, and we end up with an answer of -1. Thus, we can fill in the rectangular area as follows:

```
FOR Y = Y1 TO Y2 STEP (R1 <= R2) - (R1 > R2)
   (DRAW HORIZONTAL LINE)
NEXT Y
```

Now we are ready to collect our routines and add them to the previous program to solve the third problem.

Electronic Geoboard III

```
Procedures                      Applesoft Program
1. - 7. Same as in II           ..................
8. Shade Rectangle
(Vside 1                         80 X1 = C1 * 7 - 2:
Vside 2                             X2 = C2 * 7 - 2:
Hside 1                             Y1 = R1 * 7 - 2:
Hside 2                             Y2 = R2 * 7 - 2
From HSide1 to HSide2            81 FOR Y = Y1 TO Y2  STEP
                                       (R1 <= R2) - (R1 > R2)
  Draw horizontal line           82   Y=ROW * 7 - 2
    between                      83   HLIN X1,X2 AT Y
  VSide 1 and VSide 2)           84 NEXT Y
                                 85 RETURN
  * Main Program *              100 REM *** MAIN PROGRAM ***
  Set graphics mode             110 GOSUB 10
  Set color blue                120 GOSUB 20
    Draw border                 130 GOSUB 30
    Draw pegs                   140 GOSUB 40
  Set color white               150 GOSUB 50
Choose peg1 until in range      160 GOSUB 60
                                170  GOSUB 70
                                171  IF NOT INRANGE1 THEN 160
                                172  R1=ROW : C1=COLUMN
  Plot peg1                     173 PLOT X,Y
Choose peg2 until in range      174 GOSUB 60
                                175  GOSUB 70
                                176  IF NOT INRANGE1 THEN 174
                                177  R2=ROW : C2=COLUMN
  Plot peg2                     178 PLOT X,Y
  Shade rectangle               180 GOSUB 80
End                             200 END
```

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Exercises

One of the advantages of developing each program in a structured format is the ease with which they can be changed. Below is a small list of problems for your investigation. They can all be solved by making minor changes or additions to the subroutines in the programs displayed above.

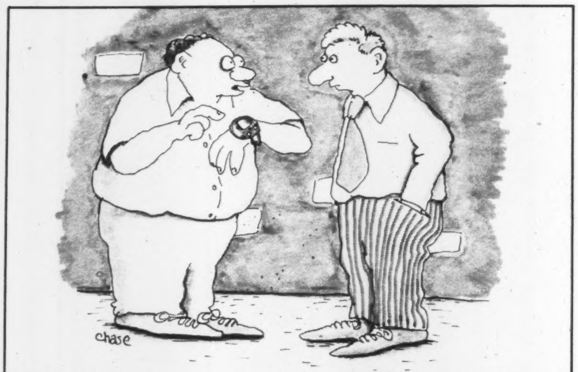
1. Write a program that will display a 36-peg Electronic Geoboard.
2. Write a program that uses a game paddle to choose points on the Electronic Geoboard. This can be done by taking the output of the game paddle (an integer between 0 and 255) and dividing it into 25 equally likely parts (try Q = INT (PDL (0)/10.5)). Each one of these integers represents a peg on the board.
3. Write a program that allows the user to choose a color and two pegs and then shades the rectangle determined by these two points the color specified. Design the program so that it will allow the user to continue to shade rectangles with different colors on the same screen.
4. Modify the program in exercise 3 to allow the user to either shade the region determined by the two pegs or the complementary region (everything but the rectangle determined by the pegs).
5. Modify the program in exercise 4 to allow the user to shade several rectangles different colors and then fill in the background a final color.

Conclusion

A criticism often made of the Basic language is that it is not structured. As we have seen, imposing a structure is possible, but is not a straightforward task. I could more quickly have written each program independently, not bothering to define separate procedures. In fact, that is how I wrote them originally.

So, why did I bother to do things the hard way? Because programmers of the future will need to know how to write structured programs. Then why didn't I use a structured language? Because Basic comes with most machines; Logo and Pascal do not. Also, the Electronic Geoboard is easier to handle in a coordinate based graphics system as opposed to a turtle graphics system.

Next month, we will continue our investigations of Electronic Geoboard but move into high-resolution graphics. ☐



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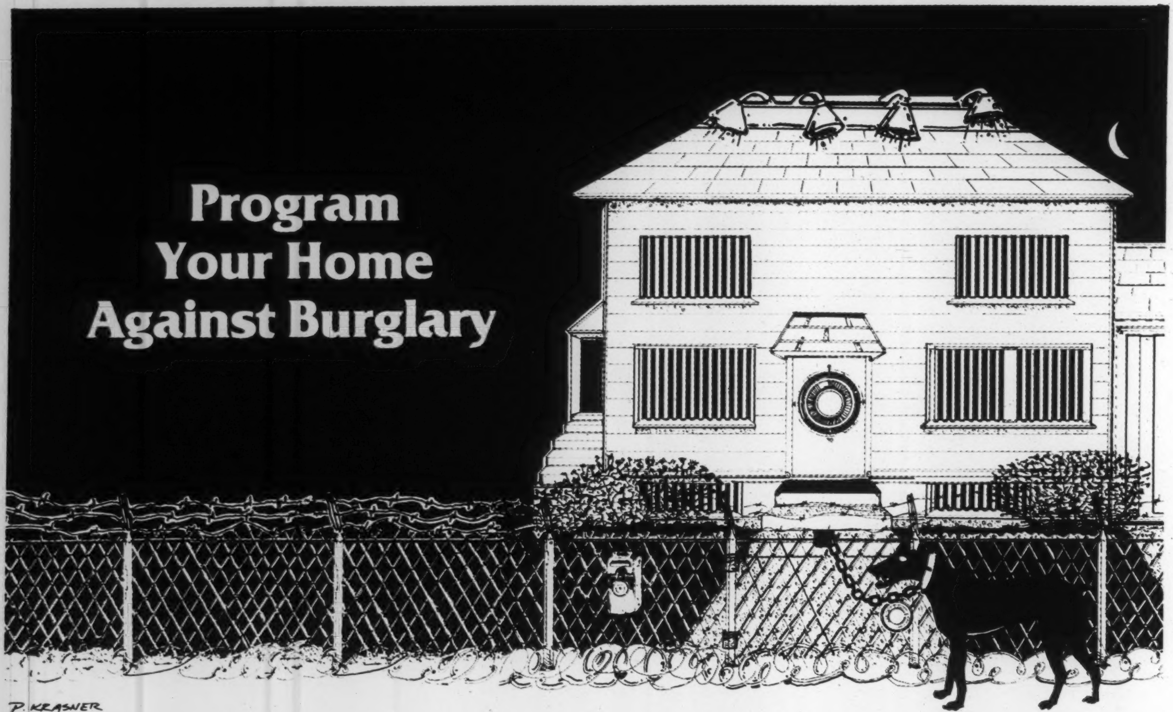
Program Your Home Against Burglary



Lawrence Block

Riding the crest of the current crime wave, the burglary rate is climbing even faster than the sales curve of personal computers. Throughout the country, in cities and suburbs and towns, hard-working burglars are jimmying locks, kicking in doors, peeling safes, and doing everything but sliding down the chimney.

If you own a personal computer, you have something they want.

Your computer makes you a target. It is a portable high-ticket item with a strong resale market. Furthermore, people who own computers are a presumably affluent lot, given to owning other articles worth a thief's attention. Small wonder, then, that gangs and individual burglars have begun to make a specialty of computer burglary.

For several years now I have been writing mystery novels about Bernie Rhodenbarr, a fictional burglar who solves murders when he's not going out a window with somebody's coin collection in tow. In the name of research I've learned as much as one can about burglary without getting arrested, and I'd like to share some of it with you.

There are three basic ways in which you can program your computer against burglary. First, you can avoid attracting a burglar's attention. Second, you can make your dwelling difficult to enter. Finally, if the burglar does get in, you can render his mission as unrewarding as possible.

How do you stay off a computer burglar's hit list? What you don't do is advertise the fact that you have something he'd be happy to steal. Don't be too quick to tell strangers about the remarkable piece of expensive hardware you've acquired. Avoid bumper stickers and similar items that tell the world you own a computer.

Avoid bumper stickers and similar items that tell the world you own a computer.

When you're away from home, don't let it show. Stop milk, mail and newspaper deliveries on all extended absences. Set electrical timers to turn lights on and off around the house. (But remember that the lone light burning day and night can draw burglars like moths. "How considerate of them," Bernie mused in one such instance, "to leave a light for the burglar."

During short term absences, a glowing television screen in the living room suggests that someone is home watching it. It may not ward off a burglar who already has his eye on you, but it can help discourage a casual prowler.

Don't let your answering service give the game away. An over-solicitous operator can tell a burglar more about your schedule than you want him to know. The same goes for those I'm-not-home-now messages on your answering machine. Don't make them too specific.

More Trouble Than It's Worth

These basic precautions won't guarantee that a burglar won't turn up. That's why you must make your home as hard to get into as possible.

You can't hope to make it absolutely burglar-proof. "A top thief could get into Fort Knox," former FBI chief Clarence M. Kelley has pointed out, and my friend Bernie Rhodenbarr agrees. "There's always a way in," he insists, "but sometimes it's more trouble than it's worth."

You can make your residence too much trouble for most burglars, and it's worth the trouble it takes you to do so.

The first step is lock the doors.

Sound obvious? In last year's two million residential burglaries, 25 percent involved entry through unlocked doors. People leave doors unlocked because they are careless, or because they are only going to be out for a few minutes, or because it's the middle of the afternoon and they are home. Then one day they are grilling hamburgers in the back

---

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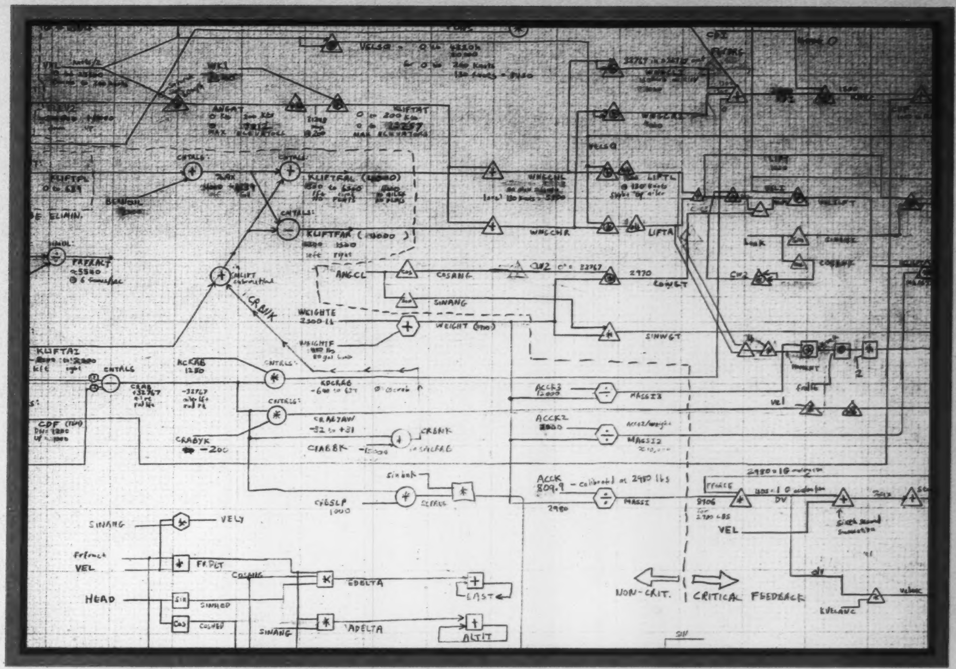

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Frontline – A fast-paced battle of wits and strategy for one or two players. Enemy forces are trying to break through one of your frontline sectors; defend them with the troops, tanks, and planes at your command. Then press your attack and attempt to penetrate the enemy line. **Frontline** requires quick offensive and defensive tactical maneuvering. For the Apple II.

Roadblock – An arcade-strategy original. You, as county sheriff, dispatch your patrol cars to surround and capture a fleeing bank robber. Since his getaway car is faster than your own pursuit vehicles, you'll have to think ahead and develop a workable envelopment strategy if you want to keep your job (and improve your score). Fast action and hi-res graphics make this one a sure-fire hit. For the Apple II.

Forest Fire Dispatcher – A realistic simulation that places you in charge of a forest district in southeastern Kentucky. Your objective is to save the maximum possible acreage from fire at the least possible cost. Many variables make for a complex, thoroughly enjoyable strategy game. For the TRS-80 Model I and Model III microcomputers.

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yard while a thief is lugging their computer out the front door.

While any lock is better than none, a sophisticated burglar can open some of them almost as quickly as if he had a key. The kind that locks automatically when you shut the door is child's play for any burglar worthy of the name. If you don't have to lock your lock with a key, he can open it with a plastic card or a screwdriver. Make sure you have sound deadbolt or drop-bolt locks on every outside door, and make sure you use them.

Burglars have several ways of dealing with locks. They spread door frames with portable jacks. They pull the lock cylinder out with vise-grip pliers. They work a prybar between door and jamb and jimmy the lock. Here's where a consultation with an expert locksmith becomes worthwhile. Let him examine your locks. He may recommend replacing some, reinforcing others with escutcheon plates, and installing angle irons to prevent jimmying. A police lock, featuring a steel bar braced against or across the door, provides further protection against the brute-force burglar.

Speaking of doors, make sure yours are equal to the task. All the locks in the world won't keep out a burglar if he can break a window pane and reach through to unlock them from within. Doors should be solid wood; the hollow-core type is too easy to kick in.

Got an attached garage? The burglar can get into it effortlessly—so treat the door leading from the house to the garage as if it were an outside door. Make sure it can stand up, and provide it with adequate locks.

Basement windows let in more burglars than sunshine. It's surprising how many homeowners overlook them, perhaps because they appear too small to admit a burglar. But human beings can wriggle through much smaller openings than you'd think. Steel mesh over those basement windows will let the light in while it keeps the burglar out.

If locks and doors are your first line of defense against burglars, second is a good alarm system. Your dealer can survey your premises and recommend the ideal system. You might choose a silent alarm, designed to ring either at police headquarters or at the offices of the security company, or the sort which makes a hellish racket to alert the neighbors and frighten off the burglar before he gets in. The silent alarm is more likely to lead to apprehension of the criminal, but I would think it less desirable if the burglar should pay his visit while you are at home and asleep. When that happens, you want something that will wake you up while it scares him off, not something to bring the police trotting along behind him.

It's tough to make a home computer look like an electric frying pan.

The *creme de la creme* of the housebreaking profession—a Bernie Rhodenbarr, say—can frequently outwit any burglar alarm. Just as there is no such thing as a pickproof lock cylinder, neither is there an utterly impregnable alarm system. But the vast majority of burglars will steer clear of a home once they determine that it is protected electronically. If they don't spot the device in advance, they'll skedaddle once it goes off.

Some homeowners have provided themselves with the deterrent effect of a burglar alarm at a fraction of the cost by displaying a sticker announcing that the premises are protected by an alarm system. It's been argued, though, that a burglar with street smarts can spot a phony sticker fifty yards off. You pay your dollar and take your choice.

Cut Your Losses

Suppose a burglar gets into your home in spite of your best efforts to keep him out. How can you cut your losses?

For a start, you can best protect your computer by participating in a program called Operation Identification. Your local police will provide you with an etching tool and show you how to mark valuable articles so that they can be instantly identified as your property. They'll also furnish you with a window sticker announcing that you participate in the program, and thus warning potential burglars that they'll have a tough time reselling anything they steal from you.

A burglar might overlook your Operation Identification decal, and might be undeterred by your etching efforts. He can always keep your computer for his own use, or give it to his cousin for Christmas. So it's worth your while to make it just a little bit harder to steal. If you always keep it in a particular position on a particular desk or table, why not bolt it in place so the thief can't carry it off?

If that's not practical, it might be worthwhile to get in the habit of camouflaging your computer when you're away from home. There's a limit to what you can accomplish in this direction—it's tough to make a home computer look like an electric frying pan—but by throwing some sort of cover over it you keep a burglar from spotting it at a glance. Remember, burglars are in a hurry. They rarely have time to take a detailed inventory. If you can tuck your computer out of sight or screen it from view, you can increase the likelihood that a thief will overlook it entirely.

By the same token, you can minimize your loss of cash and other valuables by hiding them where a burglar won't think to look. And most other valuables are a lot easier to hide than a computer.

"Hey buddy, can I interest you in some software?"

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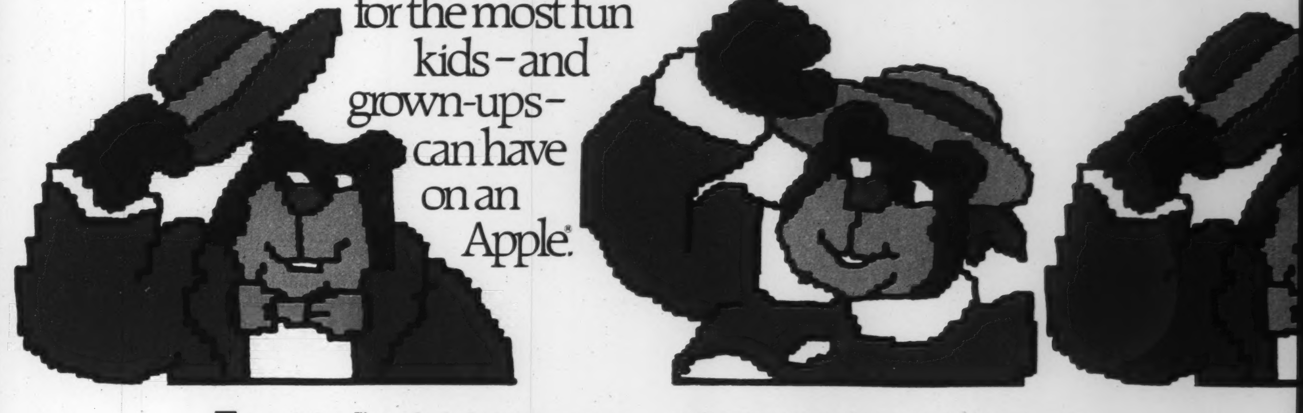

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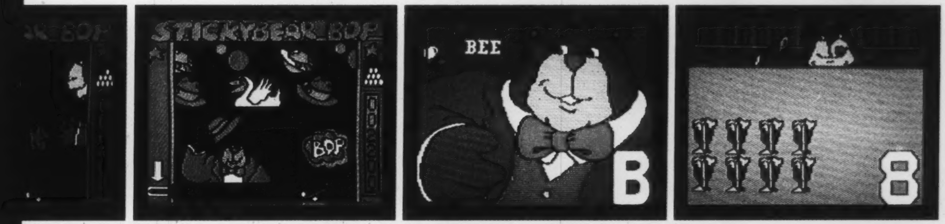

It's so simple even little kids can rack up big scores at the Stickybear Bop shooting galleries. And so exciting, the grown-ups will join right in on the thrills!

And Stickybear Bop is a complete program. Besides the disk, there's a full-size color poster, a bright, durable vinyl binder, a special stand-up game, Stickybear stickers and instructions. All for only $39.95!

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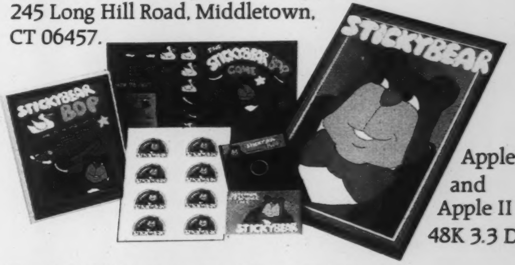

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Burglary, continued...

If you keep cash around the house, don't hide it in the refrigerator. That's where most people stash it, for some curious reason, and burglars know it. Don't use kitchen canisters, either, as a hiding place for cash or jewelry. Don't hide things in the top of the toilet tank, or in desk or dresser drawers, or on closet shelves. That's not as bad as leaving them in plain sight, but it's not much better.

Instead, use your ingenuity and devise hiding places of your own. In *Burglars Can't Be Choosers,* Bernie's own apartment gets ransacked. But his cash remains untouched because he has hidden it a bill at a time between the pages of books in his library, even glueing pages together so that shaking a book won't send bills fluttering to the floor. You can use books in this fashion, or tape bills to the undersides of drawers, or—well, use your imagination. In *The Burglar Who Studied Spinoza,* a fence of Bernie's acquaintance keeps cash in an old telephone. You'd have to take it apart to find it, and what burglar would think to do that?

If you're a fair amateur carpenter, you can build false bottoms into drawers and closet shelves. And a mail order house has lately taken to offering the cleverest wall safe I've ever seen. It looks for all the world like a standard baseboard electrical receptacle, indistinguishable from the sort you plug lamps and radios into. At the turn of a key it pulls out from the wall and reveals itself as a hiding place just large enough for a handful of jewelry or a wad of cash. Now a burglar wouldn't need a key to open it, he could pop it from its moorings in a minute, but how would he know to do it?

There's a danger, of course, in getting too clever for your own good. Just recently the papers carried a story about a young man in New Jersey who found a secret compartment in his mother's tea cart and stowed his coin collection there. He never told anybody, and one day she sold the thing for $25 in a yard sale. Away it went, along with $1500 worth of coins. If you do secret things around the house, a list of the articles and their hiding places belongs in your safe-deposit box, or with your attorney.

If you come home while a burglary is in progress, slip silently away, use a neighbor's phone, and call the police. If anything makes you even slightly suspicious, don't hesitate. Better to risk a false alarm than a confrontation.

Bernie Rhodenbarr is unarmed and committed to non-violence. But his real life counterparts don't always share this commitment. So don't take chances. Your personal computer, however much you treasure it, can always be replaced. But you're the only you you've got. ☐

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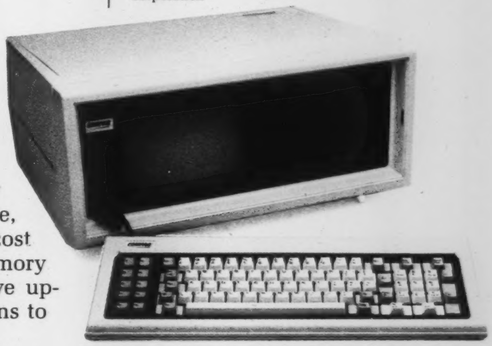

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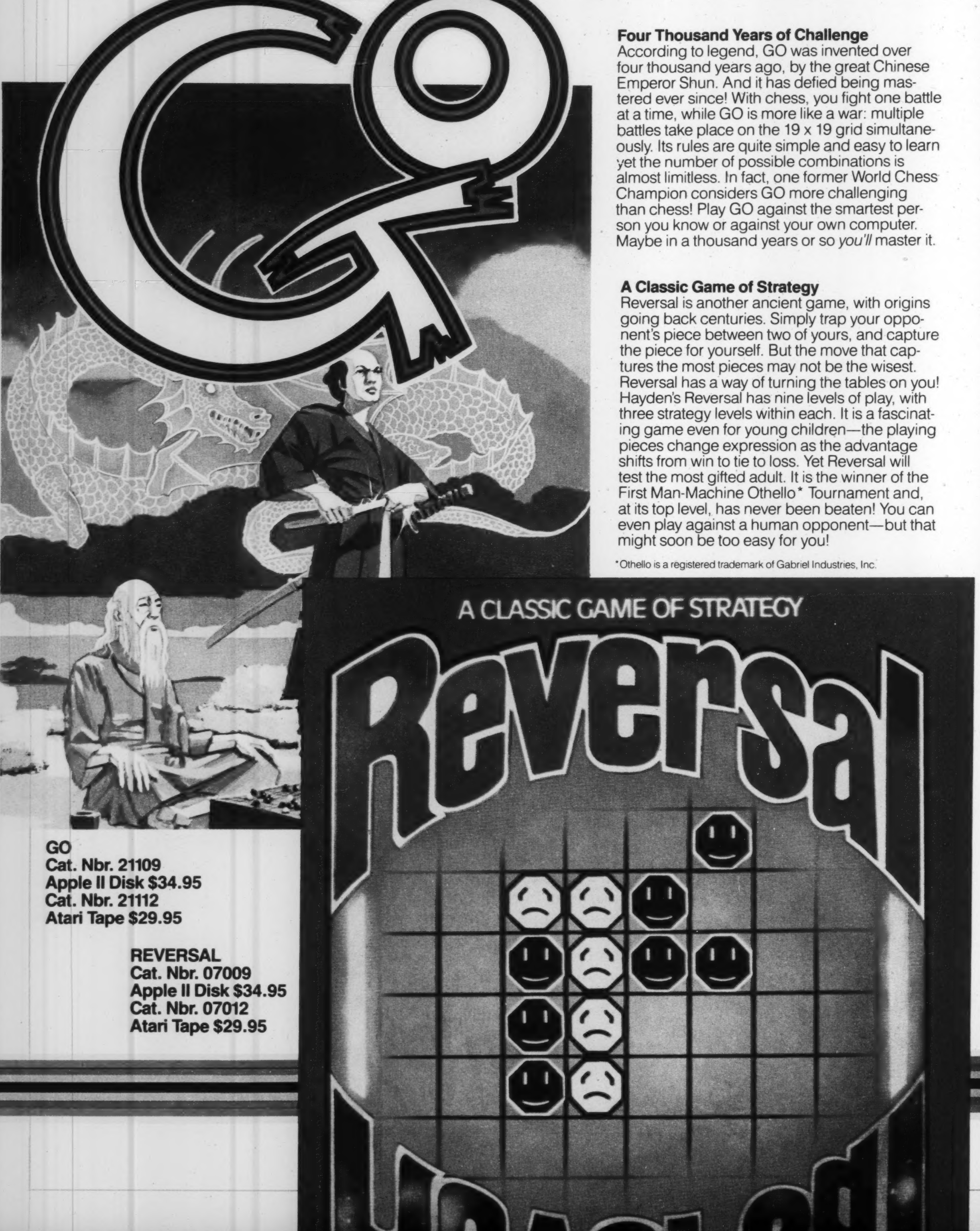
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A CLASSIC GAME OF STRATEGY
Reversal

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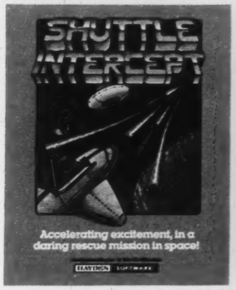
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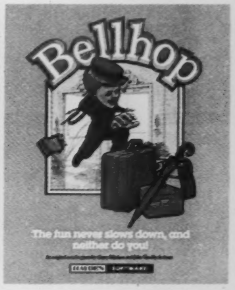
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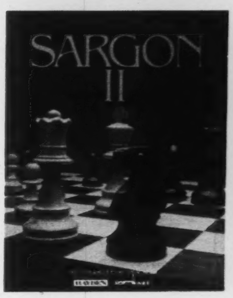
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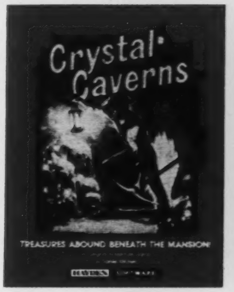
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Hayden

HAYDEN SOFTWARE. THE MIND-STRETCHERS.

SARGON
II
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Hayden

TRS-80
POLICE

Computers Against Crime

If you can't afford German shepherds, accordion wire and guard towers, here are some halfway measures.

Kel Hess

Recently my high school math department purchased four TRS-80 computers at a cost to the school board of approximately $3500. When they found out that their insurance was $1000 deductible, they decided to have an alarm system installed at a cost of another hundred dollars or more.

When I discovered this, I thought, why not have the computers monitor themselves to make certain that they don't get stolen?

The first step was to check with the local Radio Shack manager to see if it would harm a computer to be left on overnight. A negative answer gave me the go-ahead, so I thought about what I would like the computer to do as it sat idle night after night. The first and most important function that came to mind was to "watch" the rooms to see if a door was open or a window open or broken. I realized that the computer would have to do something other than just make a loud noise if there were a break-in, so I tried to think of a way to make the machine call the police (or any other number) and play a pre-recorded message.

The dialing was the easy part as I had previously worked on a program which would dial my home phone for me. The hard part was figuring out how to have the computer tell the police that there was a break-in occurring. The first thing I considered was to have the computer pick up the phone and play the tape aloud, but that wouldn't work since the person breaking in would hear the recording and stop it from playing. After much thought, I came up with the following system.

Monitoring the Doors and Windows

This is the part of the alarm that took the most time to prepare for final operation. First I had to wire all the doors and windows in the room with magnetic switches so that if a door or window were opened it would trip the alarm. Then, since I wanted to make certain that no windows were broken, I had to run window foil around all the windows.

The computer would have to do something other than just make a loud noise if there were a break-in.

After installing all the switches, I had to wire them in series so that if anyone tried to break in, he would open a switch or break the foil on the windows, thereby tripping the activator hooked to the computer. See Figure 1 for a schematic of this activator.

The computer sends an oscillating pulse to the amplifier which is then sent back into the computer. If the signal makes it back to the computer, then port 255 reads 191 which means that everything is okay. But if the curcuit is broken, the signal never makes it back to the computer, and port 255 changes to 63. So if port 255 is ever 63, it means a break-in is occurring.

The Phone Dialer and Message Player

When a person dials on the telephone all he really does is send a series of electronic pulses over the line, ranging from one pulse (representing a 1) to ten pulses (representing a 0). Therefore, to make the computer dial the telephone, I wired the cassette remote control to not only start the tape player but also to pick up the phone and dial it. I wrote the program so that it would first pick up the phone by completing the circuit between the telephone line and an isolation transformer (see Figure 2).

The remote plug connects the circuit long enough to get a dial tone, then dials the local police emergency number 911 by pulsing out through connecting and disconnecting the circuit at the right intervals. At the rate the telephone equipment in my area can handle these pulses, I found that the computer can dial 911 in just a few seconds. (This will work on any type of phone line, either dial or touch tone service.)

At the same time, the cassette control also starts the cassette tape player which repeats a pre-recorded message telling the police where the break-in is occurring.

To keep the burglar from hearing the message, I hooked the ear plug of the tape recorder to the other side of the transformer (see Figure 2) which enabled the recording to go directly over the phone lines without being heard in the room.

Kel Hess, 2111 Schubert St., Cuyahoga Falls, OH 44221.

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The only problem was that if the emergency number was busy, the computer wouldn't know the difference, and would play a recording to a busy signal.

To solve this problem I programmed the computer to play the message three times, hang up, wait a minute, then call the number again and replay the message. Just in case it was still busy, it would go through this cycle one more time. All told, the computer would contact the police and tell them of the break-in a total of three times.

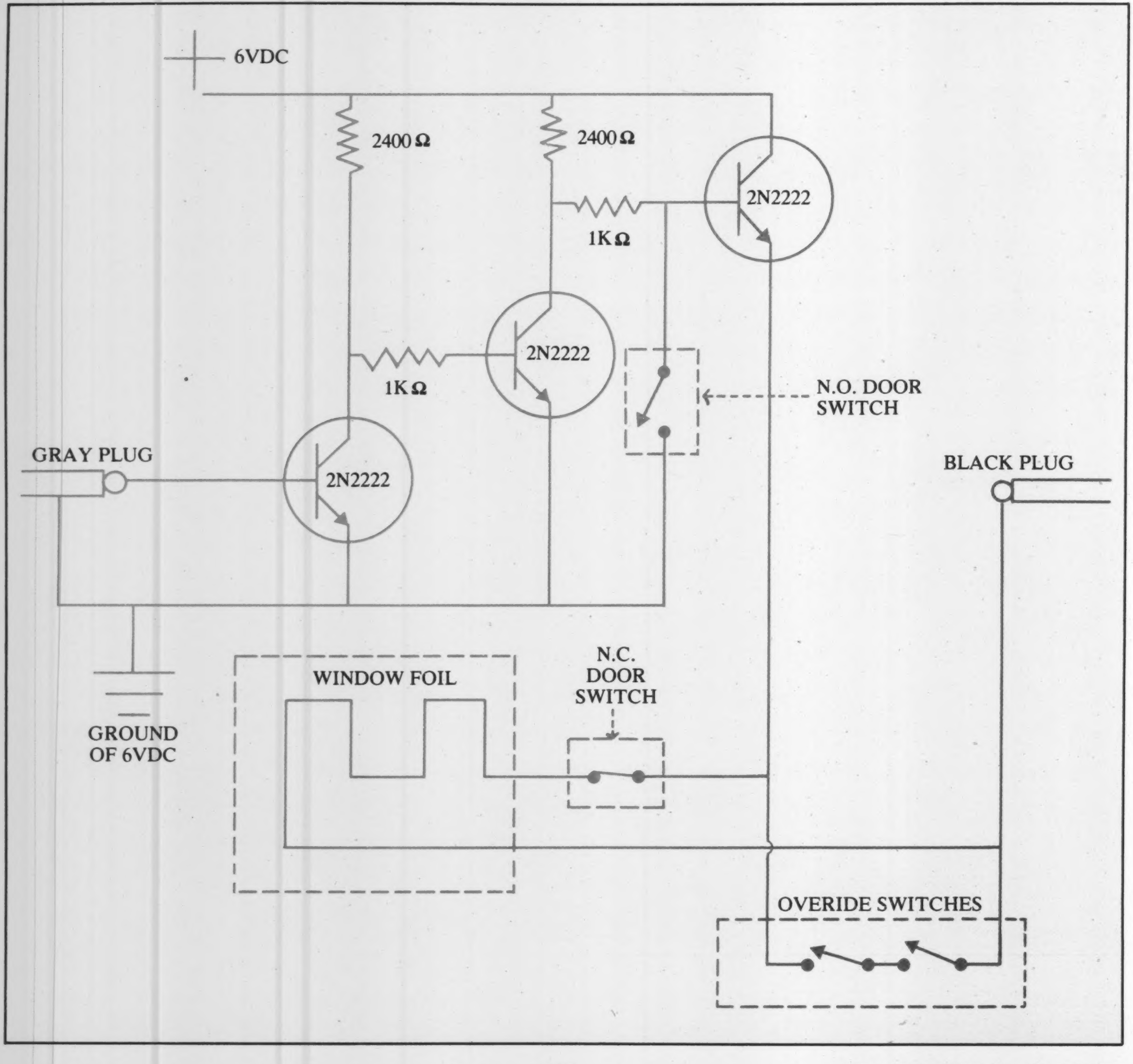
Another possibility was that the telephone might be ringing at the time of the break-in. The computer would still pick up the phone, dial, and start the recording. If a burglar knew the system he could conceivably call ahead and get the phone ringing; then the computer couldn't dial out.

To combat this the program instructs the computer to pick up the phone before dialing (to answer any possible ringing), hang up again, then immediately pick up the phone again and dial the emergency phone number.

The only aspect I haven't covered yet is how the teacher gets into the computer room in the morning without setting off the alarm. The answer to this is simple. All I did was connect two key switches that were wired in series, and wire the two in parallel with all the alarm switches (see Figure 1). I put two key switches in the circuit so that if one key was somehow duplicated, the door still could not be opened. It takes both keys to open a door, making it twice as hard to break in. When both of these switches are closed, the other switches are overridden so that when the door is opened, the circuit is still closed and the alarm does not go off.

Also in the first line of the program there is a statement that reads POKE 16396,23. This statement freezes the BREAK key which makes certain that even if the intruder knows to stop the computer by pressing the BREAK key, it won't work. The program continues to do its job whether that means monitoring

Figure 1.



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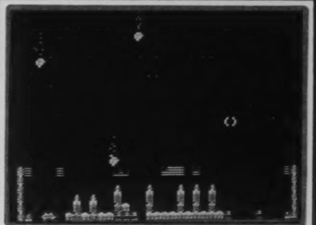

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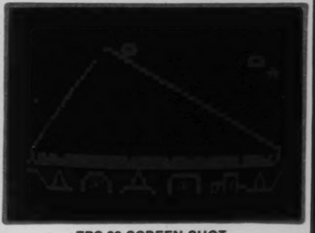

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CIRCLE 109 ON READER SERVICE CARD

the room or calling the emergency number and alerting the police.

Hardware

The activator is an amplifier which amplifies the output of the computer (what is normally fed into the cassette from the computer) and after amplification sends it back into the input (what is normally sent into the computer from the cassette). If a door switch is opened, or a window is opened or broken, the circuit opens, and the computer no longer hears the signal that it is sending out. When someone comes in the room in the morning, after they close both key switches, the circuit is kept closed and the computer continues to hear itself.

The telephone dialer and cassette starter are two devices in one. Both devices are activated by the cassette-control remote plug. When the computer activates its relay, it in turn energizes either two SPST relays (as pictured) or one DPST relay. One set of terminals goes straight to the cassette player to start it; the other goes to a 1:1 ratio (isolation) transformer which is hooked to the telephone lines (see Figure 2).

When the computer clicks out a digit, this relay pulses out the needed pulses to simulate a telephone being dialed. So that the person on the other end of the phone line can hear the recording without the person in the room hearing it, I used an isolation transformer which sends this recording directly over the telephone lines.

To set the volume control to the correct level you first have the computer call a friend, then adjust the cassette player to the correct level. This isolation transformer not only protects the cassette tape player from the telephone lines, but it also protects the telephone equipment from the cassette tape player.

The Program

Line 0 freezes the BREAK key so that no one can stop the computer once it is started. The only way of stopping it is to either turn off the power or press the reset button. Both of these buttons can be protected by a small cover of some type. (*What about pulling the plug?—Ed.*)

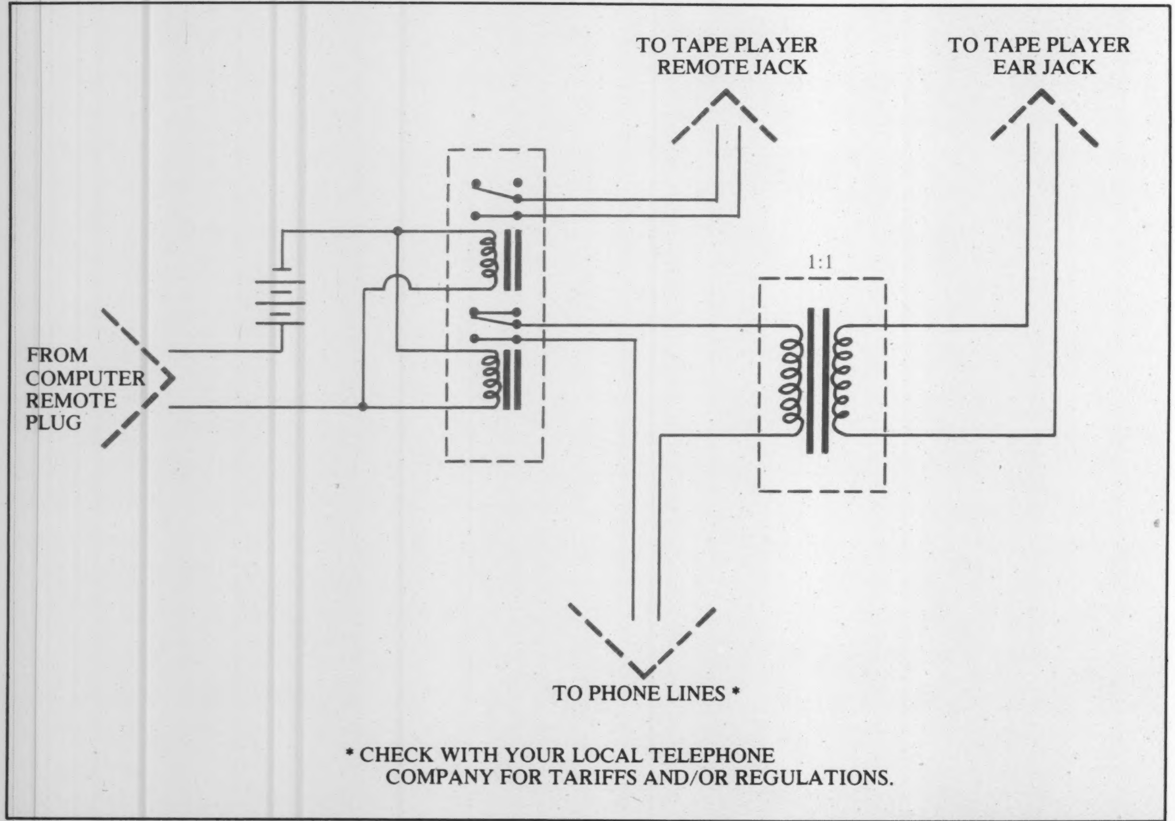
Line 10 dimensions the maximum length of the phone number to be dialed. I have it set for 15 digits (including pauses) but this length can easily be changed.

Lines 40-50 keep a constant check on the cassette port (255) to see if there has been a break-in. Line 40 sends a signal to the amplifier, and line 50 checks to see if the computer is receiving the signal (191) or not (63). If the computer is receiving the signal, then it will just keep looping here, checking the amplified signal until it goes off.

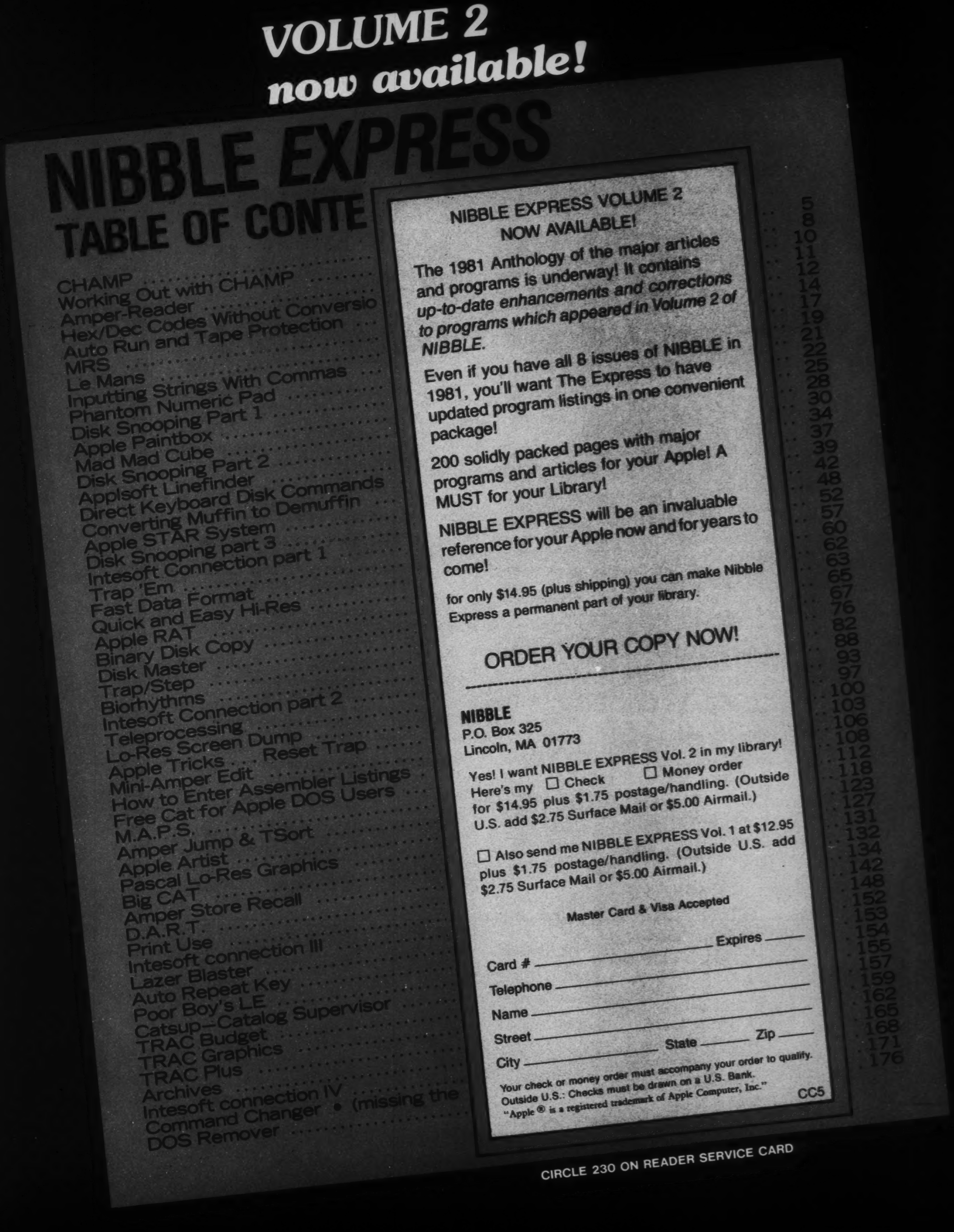
If there is a break-in, the computer gets ready to call the emergency number. Line 110 contains the telephone number that is going to be dialed. In this case it is 911, but if the alarm is inside an office where 9 must be dialed to get a dial tone, the computer must know to dial 9, then pause before dialing the emergency number. So wherever a pause is needed, insert a hyphen. For example, the emergency number programmed in the computer now would be stored as 9-911. Or if this does not provide enough time, you might need to store the telephone number as 9—911.

Lines 150-200 decipher the telephone number stored in A$. Line 170 checks to see if there are any pauses, and if so

Figure 2.



* CHECK WITH YOUR LOCAL TELEPHONE COMPANY FOR TARIFFS AND/OR REGULATIONS.



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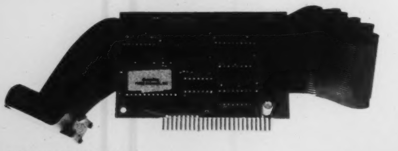

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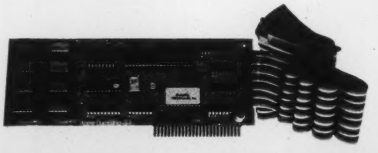

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CIRCLE 220 ON READER SERVICE CARD

Crime, continued...

converts them to 99's. If the digit called for is a zero, then to dial a zero the computer must send ten pulses over the phone lines; so line 180 changes all 0's to 10's. All of these digits are stored in B(1) to B(x), x being the total number of digits and pauses. For example a number being stored as A$."95550123" would be stored in B(1) through B(9) as 9,99,5,5,5,10,1,2,3.

Lines 210-230 just have the computer pick up the phone for a second, hang up, and then pick it up again before it starts dialing. This cycle is in case the telephone is ringing at the time of the break-in. The computer would actually hang up on whoever was calling and then proceed to call the emergency number.

Lines 240-330 are the dialing routine. Line 250 checks to see if there is a pause needed. If so, the computer pauses, then continues with the next digit. Lines 270-300 disconnect and connect the circuit to cause the dialing. The computer goes through this cycle the number of times equivalent to the digit being dialed, then waits at line 320 for a second and then goes on the next digit.

When all the digits have been dialed, the computer leaves time in line 340 for the pre-recorded message to be played; it then hangs up, waits a minute, and starts all over again. After a total of three times, or as indicated by line 140, the computer unfreezes the BREAK key, and waits for someone to arrive.

As for the pre-recorded message being sent over the telephone lines, I suggest the Radio Shack 20-second endless-loop blank tape (stock number 43-401), which is used for answering machines. Make a 20-second emergency message saying something like this...

> "This is an emergency call, there has been a break-in at 1234 Fifth Street, in room 67, on the 6th floor."

Be sure to give all the information the police will need. Then adjust line 340 so that during each call the recording is placed two or three times.

Some possible ways of changing this program would be to have the computer dial more than one person in case of a break-in. For instance, have the computer call the police, then the owner, then the programmer, then the police again. There are probably many different ways the program could be changed to better fit the needs of a specific business, but this program gives you the basics that you need. □

```
0 POKE 16396,23:'                 * FREEZES THE BREAK KEY
10 CLS:CLEAR100:DIMB(15):GOSUB1000
20 PRINTCHR$(23)
30 PRINT@534,"A R M E D";
40 OUT255,9 :OUT255,10
50 IFINP(255)=191THEN40:'   * WATCHES FOR A BREAK-IN SIGNAL
60 CLS
70 PRINT CHR$(23)
80 PRINT @384," T H E   P O L I C E   A R E"
90 PRINT@512,"B E I N G   C A L L E D   N O W"
100 '                      * THIS IS THE PHONE NUMBER, IF THERE
110 A$="911":'             * IS A PAUSE NEEDED THEN PUT A "-" IN.
120 '                      * (A PAUSE MIGHT BE NEEDED WHERE YOU
130 '                      *  MUST DIAL 9 TO GET AN OUTSIDE LINE)
140 FORER=1TO3:'    * THIS REPEATS EVERYTHING 3 TIMES
150 FORT=1TOLEN(A$)
160 B$=MID$(A$,T,1):'        * LINES 150-200 DECIFER
170 IFB$="-"THENB$="99":'    * THE TELEPHONE NUMBER.
180 IFB$="0"THENB$="10"
190 B(T)=VAL(B$)
200 NEXT
210 PRINT@P,U$;:FORT=1TO300:OUT255,12:NEXT
220 PRINT@P,D$;:FORT=1TO300:OUT255,11:NEXT:'  * LINES 210-230 ANSWER A RING
230 PRINT@P,U$;:FORT=1TO400:OUT255,12:NEXT:'  *  (IF THERE IS ONE OCCURING)
240 FORT=1TOLEN(A$)
250 IFB(T)=99THENFORR=1TO750:NEXT:GOTO290:'  * CHECKS FOR PAUSE
260 FORR=1TOB(T)
270 PRINT@P,D$;:OUT255,11
280 FORE=1TO15:NEXT:'                          * LINES 270-310 DIAL EACH
290 PRINT@P,U$;:OUT255,12:'                    * DIGIT BY CONNECTING AND
300 FORE=1TO15:NEXT:'              * DISCONNECTING THE CIRCUIT
310 NEXT
320 FORE=1TO300:NEXT:'        * WAITS A SECOND BEFORE NEXT DIGIT
330 NEXTT
340 PRINT@P,U$;:FORT=1TO2600:OUT255,12:PRINT@P+12,"*@*";:PRINT@P+12,"@*@";:NEXT:
'  * WHEN ALL DIGITS ARE DIALED
350 PRINT@P+12,"   ";:PRINT@P,D$;:FORT=1TO2000:OUT255,11:NEXT:'
   * COMPUTER HANGS UP, WAITS
360 NEXT ER:'
   * AND STARTS AGAIN.
370 CLS:PRINTCHR$(23);
380 PRINT@448,"T H E R E   H A S   B E E N"
390 PRINT@586,"A   B R E A K - I N"
395 PRINT@P,D$;:
400 POKE16396,201:'      * UN-FREEZES BREAK KEY
410 GOTO 410
1000 D$=CHR$(188)+CHR$(140)+CHR$(140)+CHR$(140)+CHR$(188)+STRING$(4,CHR$(24))+CH
R$(26)+STRING$(3,CHR$(191))
1010 U$=CHR$(143)+CHR$(131)+CHR$(131)+CHR$(131)+CHR$(143)+STRING$(4,CHR$(24))+CH
R$(26)+STRING$(3,CHR$(191))
1015 P=856
1020 RETURN
```

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The Secret Code Machine

Gordon Ritchie

Millions of dollars are spent every year by governments, east and west, on computers to make and break secret codes. Using a century-old technique on a modern microcomputer, the user of the program described in this article can encipher and decipher secret messages and may also get a taste of the fascinating history of cryptanalysis.

The Playfair Cipher

The ideal cipher should be very simple to construct but impossible to break. One of the simplest, and most effective (though by no means unbreakable with modern methods) is the Playfair Cipher. Invented more than 125 years ago, this cipher retains its utility for casual use today, having made its mark on history in helping save the life of a future president of the United States.

The inventor was a British genius, Charles Wheatstone. Wheatstone had many and varied interests. Among other accomplishments, he invented that charming musical instrument, the concertina. He produced some of the earliest stereoscopic or three-dimensional drawings, and he published numerous papers on the science of acoustics. He also improved the electric dynamo and gave his name to a method, still in use today, for the very accurate measurement of electrical resistance.

For his many achievements, Wheatstone was knighted by Queen Victoria. He was elected to the Royal Society, and named professor of experimental philosophy at King's College, London, despite the fact that this remarkable man was so shy he almost never appeared in person to give a lecture.

At the center of his interests lay telegraphy. He constructed an electric telegraph well before Samuel Morse succeeded, and made a contribution to the study of underwater telegraphy. Finally, and most important for this article, he devised an entirely new method for encoding secret messages to be sent by telegraph.

The cipher was ultimately named after Wheatstone's friend, Lyon Playfair, first Baron Playfair of St. Andrews. He first demonstrated what he described as "Wheatstone's newly-discovered symmetrical cypher" at a very private dinner in London in January 1854. The select company that night included Queen Victoria's husband, Prince Albert, and the Home Secretary (and late distinguished Prime Minister), Lord Palmerston. The demonstration was received with great interest. Indeed, several days later, while Playfair was visiting Dublin, he received letters from several of that night's guests, encoded, naturally, in the new cipher which had proved so easy to master.

The event marked the introduction of a method of enciphering letters in pairs such that the result depended upon the interaction of both elements. Today, this is recognized as the first "literal, digraphic" cipher in history.

The Playfair cipher begins with a 5 × 5 grid. Each block of the grid holds one of 25 letters of the alphabet (the j is dropped, to be replaced as needed by an i throughout).

The initial letters of this array, in the usual order (left to right along each row from top to bottom) are taken from a keyword known to both sender and receiver. This can be any word or phrase whatsoever. Its letters are arrayed in order of the first appearance. Thus, the key word "playfair" would be read as "p l a y f i r." The remaining letters of the alphabet follow, in alphabetical order, to make up the codesquare. Thus, using the keyword "playfair," the codesquare is:

P L A Y F
I R B C D
E G H K M
N O Q S T
U V W X Z

The secret message is processed through this codesquare, in pairs of letters. First, all j's are replaced with i's. Then the message is broken down into pairs. If both letters in any pair are identical, a dummy (an x) is inserted. A dummy is also used to round off the message to an even number of letters. Thus, the short message, "a good cipher is the playfair" becomes:

AG / OX / OD / CI / PH / ER / IS
TH / EP / LA / YF / AI / RX

The rules for encoding a message are simplicity itself. Each letter in a pair is found in the codesquare. It is replaced by the letter on the same row but in the column of the other letter of the pair. Thus, AG becomes LH, OX becomes SV, etc. There are two special cases:

- If both letters are on the same row (e.g., YF), each is replaced by the letter

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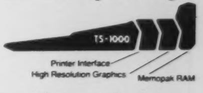

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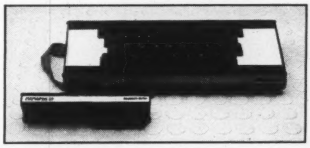

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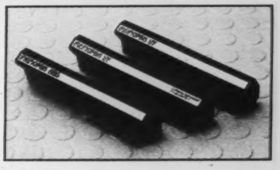
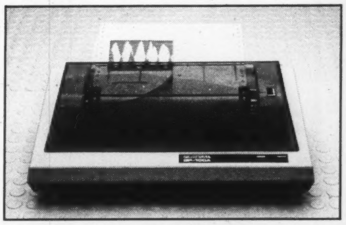


SEIKOSHA GP 100A PRINTER The Seikosha GP 100A uses a 5x7 dot matrix printing format with ASCII standard upper and lower case character set. Printing speed is 30 characters/second with a maximum width of 80 characters. The printer uses standard fanfold paper up to 9-1/2 inches wide. The GP 100A is offered as a package including cable and interface. Other printer packages are also available through Memotech.



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City ____________ State ______ Zip ______ to the right, scrolling around to the beginning of the row as required (i.e., YF becomes FP).

- If both letters are in the same column (e.g., EP), each is replaced by the letter below, scrolling to the top of the column (i.e., EP becomes NI).

Our sample message, using the keyword "playfair" thus becomes: LHSVTR DRAEGI CNQMNI AYFPPB CV. (The grouping of letters is purely arbitrary, to mislead prying eyes.) The reader may wish to double check—it is really rather easy once you understand the method.

The power of the cipher can be seen in the way that O is enciphered S in one place and T another, while A in the ciphertext stands for P in one case and L in the other. The result is that the simplest method of attack on secret ciphers, frequency analysis, is made much more difficult.

The two most frequent letters in English are e and t which together account for more than 20 percent of all normal usage. By contrast, the two most common di-graphs, th and he are found less than 6 percent of the time. This method of enciphering in pairs can be broken by modern methods, to be sure, but not without some skill.

The proof of this came in the rescue of an American sailor who later became president of the United States of America. When PT 109 was rammed and sunk in August 1943, the coastwatchers were on the alert. A member of the Australian naval volunteer reserve hidden in the Solomon Islands saw the explosion.

That morning, he received a message in Playfair cipher using the keyword "Royal New Zealand Navy" which said, "PT boat one owe nine lost in action in Blackett Strait two miles SW Meresu Cove X Crew of twelve X Request any information X." He reported his sightings and over the next few days he and his brave comrades on different islands exchanged a stream of messages about the probable whereabouts of the survivors.

Five days later, he learned that two natives had, indeed, found the sailors, and he fired off a message, using a Playfair cipher with the keyword "physical examination" to report eleven survivors and call for a rescue. In the heart of Japanese-controlled territory, with the radio waves continuously monitored, the use of a simple Playfair cipher kept the proceedings secret until the rescue could be effected.

The Playfair Program

You don't need to be on a South Sea island surrounded by enemy forces to use and enjoy the Playfair cipher. The following program was written for Boy Scout Martin Ritchie of Ottawa, Canada, as part of his requirement for a green star. The user simply inputs an appropriate key word and the computer does the rest of the work, enciphering or deciphering the secret message.

The program was originally written on the 6502 system of a SuperPet with disk drives and a CBM printer. It can be easily adapted to other Commodore machines or, with a little effort, other 6502-based systems using disk or tape. (A neighbor is running a version on a tape-supported CBM 2032.)

```
10 REM  *            PLAYFAIR
20 REM  *    *********************************
40 REM  * WRITTEN BY GORDON RITCHIE FOR HIS SON MARTIN
50 REM  * AT OTTAWA, 5 DECEMBER 1982
70 REM  * AN OPERATING CIPHER MACHINE WHICH ENCIPHERS/DECIPHERS MESSAGES USING
80 REM  * THE PLAYFAIR SQUARE TECHNIQUE BASED ON KEY WORD SUPPLIED BY USER.
100 REM *
110 REM * MAIN VARIABLES  :-
120 REM *          KE$          = KEYWORD
130 REM *          K1$          = KEYWORD (REVISED)
140 REM *          AB$          = ALPHABET STRING ('ABCDEF...')
150 REM *          MS$(5,5)     = PLAYFAIR MAGIC SQUARE
160 REM *          ME$(500)     = MESSAGE STRINGS IN PLAIN TEXT
170 REM *          MC$(500)     = MESSAGE STRINGS IN CIPHER
180 REM *          LE           = LENGTH OF MESSAGE
200 REM * INPUT FROM KEYBOARD :-
210 REM *          KEYWORD      = KE$
220 REM *          MESSAGE      = ME$(500)
240 REM * OUTPUT TO SCREEN &/OR PRINTER  :-
250 REM *          KEYWORD      = K1$
260 REM *          CODESQUARE   = MS$(5,5)
270 REM *          CIPHERTEXT    = MC$(500)
290 REM * HARDWARE REQUIRED  :-
300 REM *           CBM 8032 (WILL ALSO RUN ON 'FAT FORTY')
310 REM *           CBM PRINTER (FRICTION OR TRACTOR FEED)
500 REM ****MAIN PROGRAM BLOCK*******************************************
540 PRINTCHR$(142)  : REM * SELECT GRAPHICS
550 PRINTCHR$(147):PRINT:PRINT:PRINT:PRINT
555 PRINTTAB(10)"▓PLAYFAIR CODE MACHINE■"
560 PRINTTAB(10)"*********************"
570 PRINT:PRINT
580 PRINT"WELCOME TO THE ▓PLAYFAIR CODE MACHINE■."
630 PRINT:PRINT:PRINT
640 PRINT"A PROGRAM WRITTEN BY GORDON RITCHIE FOR"
650 PRINT"HIS SON MARTIN, BOY SCOUT, IN OTTAWA,"
660 PRINT"ONTARIO, CANADA."  : PRINT  : PRINT
670 GOSUB 6000  : REM * PAGE TURNER
680 DIM MS$(5,5), ME$(500), MC$(500)
700 PRINTCHR$(147)
710 PRINTTAB(10)"▓KEY WORD■"
720 PRINTTAB(10)"********"
730 PRINT:PRINT
740 PRINT"THE FIRST STEP IS FOR YOU TO DEFINE THE ▓KEY WORD■."
750 PRINT
760 PRINT"IT IS THIS ▓KEY WORD■ THAT MAKES YOUR CODE DIFFERENT"
770 PRINT"FROM ANY OTHER, AND ALMOST IMPOSSIBLE TO BREAK."
780 PRINT
790 PRINT"CHOOSE IT VERY CAREFULLY. IT SHOULD BE:"
800 PRINT
802 PRINTTAB(5)"* A SINGLE WORD (NO SPACES)
804 PRINT
810 PRINTTAB(5)"* EASY TO REMEMBER"
820 PRINT
830 PRINTTAB(5)"* NOT TOO LONG (3 - 15 LETTERS)
840 PRINT
850 PRINTTAB(5)"* NOT TOO OBVIOUS (DON'T ALWAYS USE YOUR NAME!)
860 PRINT
870 PRINT"PLEASE ENTER YOUR ▓KEY WORD■ BELOW:"
880 INPUT KE$
890 IF LEN(KE$) < 3 THEN PRINT"TOO SHORT.": GOTO 780
900 IF LEN(KE$)>15 THEN PRINT"TOO LONG.": GOTO 780
910 FOR N = 1 TO LEN(KE$)  : REM * CHECKS FOR SPACES & JUNK
920 :    TT$=MID$(KE$,N,1)
930 :    IF TT$ = " " THEN PRINT"NO SPACES PLEASE!!":GOTO 860
940 :    IF ASC(TT$)<65 OR ASC(TT$)>90 THENPRINT"LETTERS ONLY PLEASE!!":GOTO860
950 NEXT N
960 GOSUB 10000: REM * CALLS KEYWORD ROUTINE
1020 PRINTTAB(10)"▓MAGIC SQUARE■"
1030 PRINTTAB(10)"************"
1040 PRINT:PRINT
1050 PRINT"THE SUPERPET IS NOW WORKING TO DEFINE YOUR"
1060 PRINT:PRINTTAB(10)"▓MAGIC SQUARE■"
1070 PRINT
1090 PRINT
1110 PRINT"THAT PROJECT IS NOW COMPLETED."
1120 PRINT
1130 PRINT"WOULD YOU LIKE TO SEE YOUR MAGIC SQUARE?"
1140 GOSUB 5000  : REM * RESPONSE ROUTINE
```

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Code Machine, continued...

```
1145 PRINT
1150 IF RR$ = "Y" THEN GOSUB 12000:REM * CALLS SQUARE PRINT SUBROUTINE
1160 GOSUB 6000 : REM * PAGE TURNER
1200 REM
1210 PRINTTAB(10)"▓SECRET MESSAGE■"
1220 PRINTTAB(10)"**************"
1230 PRINT:PRINT
1240 PRINT"NOW FOR THE MOST IMPORTANT STEP, YOUR SECRET MESSAGE!"
1250 PRINT"IT CAN CONTAIN UP TO 500 LETTERS IN ANY LANGUAGE."
1260 PRINT
1270 PRINT"DO YOU WISH TO:"
1280 PRINTTAB(5)"▓E■NCODE YOUR MESSAGE IN SECRET CODE (TYPE ▓E■)"
1290 PRINTTAB(5)"▓D■ECODE A MESSAGE INTO PLAIN TEXT   (TYPE ▓D■)"
1300 PRINT"WHICH DO YOU CHOOSE:";
1310 GET RR$:IF RR$ = "" THEN GOTO 1310
1315 IF RR$ <> "E" AND RR$ <> "D" THEN PRINT"(▓E■ OR ▓D■)":GOTO 1300
1320 IF RR$="E" THEN CD = 1:CD$ = "CIPHERED": PRINT "▓E■NCODE"
1330 IF RR$="D" THEN CD = -1:CD$ = "PLAINTEXT": PRINT "▓D■ECODE"
1340 GOSUB 6000 : REM * PAGE TURNER
1350 GOSUB 14000 : REM * CALLS SECRET MESSAGE ROUTINE
1360 REM * SCREEN PRINTS SECRET MESSAGE
1370 PRINTTAB(10)"▓YOUR SECRET MESSAGE ";CD$;"■"
1380 PRINTTAB(10)"********************************"
1390 PRINT:PRINT
1400 PRINT"YOUR MESSAGE ORIGINALLY WAS:"
1410 PRINT
1420 FOR N = 1 TO LE
1430 :    PRINTME$(N);" ";
1440 NEXT N
1450 PRINT
1460 PRINT"YOUR ";CD$;" MESSAGE IS:"
1470 PRINT
1480 FOR N = 1 TO LE
1490 :    PRINTMC$(N);" ";
1500 NEXT N
1510 GOSUB 6000 : REM * PAGE TURNER
2000 REM * SETS UP PRINTOUT ROUTINE
2010 PRINTCHR$(147):PRINT:PRINT
2020 PRINTTAB(10)"▓MESSAGE PRINTOUT■"
2030 PRINTTAB(10)"****************"
2040 PRINT:PRINT
2050 PRINT"NOW THE SUPERPET WOULD BE PLEASED TO PRINT"
2060 PRINT"YOUR SECRET MESSAGE OUT --- JUST AS IT WOULD"
2070 PRINT"COME OFF THE TELETYPE MACHINE IN THE SECRET"
2080 PRINT"HEADQUARTERS."
2090 PRINT
2100 PRINT"DO YOU WISH A PRINTOUT?";
2110 GOSUB 5000 : REM * RESPONSE ROUTINE
2120 IF RR$ = "Y" THEN GOSUB 22000:REM * CALLS MESSAGE PRINTOUT SUBROUTINE
2130 PRINT"DO YOU WISH TO RUN THE PLAYFAIR CODE MACHINE AGAIN?"
2140 GOSUB 5000 : REM * RESPONSE ROUTINE
2150 IF LEFT$(RR$,1) = "Y" THEN GOTO 700
2160 END : REM * END OF PROGRAM AS OF 7 DECEMBER 1982
4990 REM ********RESPONSE SUBROUTINE*************************************
5000 PRINTTAB(5)"('▓Y■ES' OR '▓N■O')"
5020 GET RR$ : IF RR$ = "" THEN GOTO 5020
5030 IF LEFT$(RR$,1) <> "Y" AND LEFT$(RR$,1) <> "N" THEN GOTO 5010
5040 RETURN
5990 REM ***************************************************************
6000 REM * PAGE TURNER SUBROUTINE
6010 PRINT
6020 PRINT"PRESS ANY KEY WHEN READY TO PROCEED."
6030 GET RR$ : IF RR$ = "" THEN GOTO 6030
6040 PRINTCHR$(147):PRINT:PRINT
6050 RETURN
9990 REM *****KEYWORD SUBROUTINE****************************************
10000 FOR M = 1 TO LEN(KE$) : REM * CHANGES 'J' TO 'I'
10020 IF MID$(KE$,M,1)="J"THEN KE$=LEFT$(KE$,M-1)+"I"+RIGHT$(KE$,LEN(KE$)-M)
10030 NEXT M
10040 K1$ = LEFT$(KE$,1)
10050 FOR M = 2 TO LEN(KE$)
10060 :   A$ = MID$(KE$,M,1)
10070 :   FOR N = 1 TO M-1
10080 :       IF MID$(KE$,N,1) = A$ THEN GOTO 10110:REM * DROP LETTER
10090 :   NEXT N
10100 :   K1$ = K1$ + A$
10110 NEXT M
10120 PRINT
10130 PRINT"THE ▓KEY WORD■ WE WILL USE (DROPPING REPEATS) IS:";
10135 PRINT"▓";K1$;"■."
10140 PRINT
10145 GOSUB 11000 : REM * CALLS MAGIC SQUARE SUBROUTINE
10150 GOSUB 6000 : REM * PAGE TURNER
10160 RETURN : REM * BACK TO 960
10990 REM ****MAGIC SQUARE SUBROUTINE***********************************
11000 AB$ = "ABCDEFGHIKLMNOPQRSTUVWXYZ"
11020 ST$ = K1$ + AB$
11030 S1$ = LEFT$(ST$,1)
11040 FOR M = 2 TO LEN(ST$)
11050 :     B$ = MID$(ST$,M,1)
11060 :     FOR N = 1 TO M-1
11070 :         IF MID$(ST$,N,1) = B$ THEN GOTO 11100
```

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Code Machine, continued...

Unlike the Waterloo Basic of the 6809 chip, which the SuperPet also supports, Commodore's Basic 4.0 is not structured, nor does it permit "pretty printing." The program has, however, been written in modular format, with extensive use of subroutines and a proliferation of REMs to make it easily readable by the novice programmer. Pseudo pretty printing has been used as well.

All this adds to the intelligibility, but also the memory requirement of the program. Users faced with limited memory capacity may wish to shorten the message array (DIM in line 680) as a first step. If the program is to be compressed, care should be taken with branching to REM statements.

The program is relatively foolproof. It also uses input time to do the main processing so that it appears to do the encipherment instantly (a useful technique known as "parallel processing").

Program Organization

Lines 10 to 310 provide a synopsis of the program using REM statements.

Lines 500 to 680 introduce the program to the screen and establish DIM, character sets, etc.

Lines 700 to 1000 accept the keyword input, strip it of j's and repeats and set up the magic square while waiting.

Lines 1020 to 1200 display the magic codesquare for the user.

Lines 1210 to 1350 accept the input of the secret message to be enciphered/deciphered and do the job while waiting.

Lines 1360 to 1500 print to the screen both the original message and the enciphered/deciphered version.

Lines 2000 to 2150 close the operation with a set of printout options to the CBM printer.

The remaining lines comprise subroutines for everything from turning the page to enciphering the secret message, all clearly marked with REMs. The basic algorithm for enciphering the letter pairs is in the 15000 block, calling subroutines for special cases in the 20000 block.

Further Information

Readers whose appetite has been whetted to learn more of the fascinating history of cryptanalysis are encouraged to get *The Codebreakers* by David Kahn or *Secret and Urgent* by Fletcher Pratt. Both provide thrilling accounts of cryptanalysis in action and a good technical guide to many of the basic techniques.

Readers who prefer not to type in the following listing may obtain a copy of the Playfair program—either version: 80-character plus instructions on disk; or 40-character on disk or tape. Just send $5 with your name and address to me at the address printed at the beginning of the article. ☐

```
 11080 :      NEXT N
 11090 :      S1$ = S1$ + B$ : REM * MAKES UP CODESTRING
 11100 NEXT M
 11110 REM * NOW SETS UP SQUARE
 11120 FOR Y = 1 TO 5
 11130 :      FOR X = 1 TO 5
 11140 :      MS$(Y,X) = MID$(S1$,X+5*(Y-1),1)
 11150 :      NEXT X
 11160 NEXT Y
 11170 RETURN : REM * BACK TO 1080
 11990 REM *****SQUARE PRINT SUBROUTINE***********************************
 12000 FOR Y = 1 TO 5
 12020 :      FOR X = 1 TO 5
 12030 :           PRINTMS$(Y,X);" ";
 12040 :       NEXT X
 12050 :       PRINT
 12060 NEXT Y
 12070 PRINT:PRINT
 12100 RETURN : BACK TO 1150
 13990 REM *****SECRET MESSAGE SUBROUTINE**********************************
 14000 PRINTCHR$(147):PRINT:PRINT
 14020 PRINTTAB(10)"▚SECRET MESSAGE■"
 14030 PRINTTAB(10)"**************"
 14040 PRINT:PRINT
 14050 PRINT"PLEASE TYPE IN YOUR MESSAGE ▚VERY CAREFULLY■. ENTER TWO LETTERS"
 14060 PRINT"TYPE 'XX' TO END YOUR MESSAGE. GOOD LUCK!"
 14070 PRINT
 14090 PRINTTAB(5)"* LETTERS ONLY - NO SPACES, NUMBERS OR SYMBOLS"
 14100 PRINT
 14110 PRINTTAB(5)"* 'J' WILL BE WRITTEN AS 'I'"
 14120 PRINT
 14130 PRINTTAB(5)"* IF BOTH LETTERS IN A PAIR ARE THE SAME, STICK AN 'X' IN"
 14140 PRINTTAB(7)"BETWEEN THEM (THUS 'SP OO LS' BECOMES 'SP O▚X■ OL S...')"
 14150 PRINT
 14160 PRINT"**********************************************************"
 14170 PRINT
 14180 FOR M = 1 TO 500
 14190 PRINT"TYPE IN THE NEXT TWO LETTERS (NO DOUBLES) THEN PRESS ▚RETURN■:"
 14200 INPUT ME$(M)
 14210 IF LEFT$(ME$(M),2) = "XX" THEN LE = M-1: GOTO 14350
 14220 PRINT:PRINT"PLEASE CONFIRM THAT ";ME$(M);" IS O.K."
 14230 GOSUB 5000 : REM * RESPONSE ROUTINE
 14240 IF RR$ = "N" THEN PRINT:PRINT"▚CORRECTION■":GOTO 14190
 14245 PRINT
 14250 REM * DATA ENTRY CHECK
 14260 IF LEN(ME$(M))<> 2 THEN PRINT"▚TWO LETTERS ONLY PLEASE■": GOTO 14190
 14270 FOR N = 1 TO 2
 14280 DD$ = MID$(ME$(M),N,1)
 14290 IF DD$ = " " THEN PRINT"▚NO SPACES PLEASE■!": GOTO 14190
 14300 IF ASC(DD$)<65 OR ASC(DD$)>90 THEN PRINT"▚LETTERS ONLY PLEASE■!":GOTO 141
90
 14310 NEXT N
 14320 IF LEFT$(ME$(M),1) = RIGHT$(ME$(M),1) THEN PRINT"▚NO DOUBLES■":GOTO14190
 14330 GOSUB 15000 : REM * CALLS ENCYPHERMENT SUBROUTINE
 14335 PRINT
 14340 NEXT M
 14350 PRINT"MESSAGE COMPLETED."
 14360 GOSUB 6000 : REM * PAGE TURNER
 14370 RETURN : REM 1350
 14990 REM *****ENCYPHERMENT SUBROUTINE*************************************
 15000 G1$ = LEFT$(ME$(M),1)
 15020 G2$ = RIGHT$(ME$(M),1)
 15030 FOR Y = 1 TO 5
 15040 :   FOR X = 1 TO 5
 15050 :        IF G1$ = MS$(Y,X) THEN Y1 = Y : X1 = X
 15060 :        IF G2$ = MS$(Y,X) THEN Y2 = Y : X2 = X
 15070 :   NEXT X
 15080 NEXT Y
 15090 REM * SQUARE
 15100 H1$ = MS$(Y1,X2)
 15110 H2$ = MS$(Y2,X1)
 15120 REM * SAME COLUMN
 15130 IF X1 = X2 THEN GOSUB 20000
 15140 REM
 15150 REM * SAME ROW
 15160 IF Y1 = Y2 THEN GOSUB 20100
 15170 REM
 15180 MC$(M) = H1$ + H2$
 15250 RETURN : REM * RETURNS TO SECRET MESSAGE SUBROUTINE (14330 BLOCK)
 16000 REM * MESSAGE PRINT ROUTINE
 16010 PRINTCHR$(147):PRINT:PRINT
 16020 PRINTTAB(10)"▚CODED MESSAGE■"
 16030 PRINTTAB(10)"*************"
 16040 PRINT
 16050 PRINT"HERE IS YOUR SECRET MESSAGE IN SUPERSECRET CODE."
 16060 PRINT
 16070 FOR M = 1 TO LE
 16080 :      PRINT" ";
 16090 :      PRINTME$(M);
 16100 NEXT M
 16110 PRINT". (THE END)"
 16120 PRINT:PRINT
 16130 PRINT"PRESS ANY KEY TO CONTINUE."
```

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Code Machine, continued...

```
16140 GET RR$:IF RR$ = "" THEN GOTO 16140
16150 RETURN : REM * END OF MESSAGE PRINT ROUTINE
19990 REM *****SAME COLUMN SUBROUTINE************************************
20000 Y3 = Y1 + CD
20020 IF Y3 < 1 THEN Y3 = Y3 + 5
20030 IF Y3 > 5 THEN Y3 = Y3 - 5
20040 Y4 = Y2 + CD
20050 IF Y4 < 1 THEN Y4 = Y4 + 5
20060 IF Y4 > 5 THEN Y4 = Y4 - 5
20070 H1$ = MS$(Y3 , X1)
20080 H2$ = MS$(Y4 , X1)
20090 RETURN
20099 REM ********SAME ROW SUBROUTINE*******************************
20100 X3 = X1 + CD
20120 IF X3 < 1 THEN X3 = X3 + 5
20130 IF X3 > 5 THEN X3 = X3 - 5
20140 X4 = X2 + CD
20150 IF X4 < 1 THEN X4 = X4 + 5
20160 IF X4 > 5 THEN X4 = X4 - 5
20170 H1$ = MS$(Y1 , X3)
20180 H2$ = MS$(Y1 , X4)
20190 RETURN
21990 REM ******PRINTOUT SUBROUTINE*************************************
22000 PRINT
22020 PRINT"DO YOU WISH TO PRINT OUT THE KEY WORD?"
22030 GOSUB 5000 : REM * RESPONSE ROUTINE
22040 IF RR$ = "N" THEN G$ = "N"
22050 PRINT
22060 PRINT"DO YOU WISH TO PRINT OUT THE MAGIC SQUARE?"
22070 GOSUB 5000 : REM * RESPONSE ROUTINE
22080 IF RR$ = "Y" THEN H$ = "Y"
22090 PRINT
22100 PRINT"DO YOU WISH TO PRINT OUT THE ORIGINAL MESSAGE?"
22110 GOSUB 5000 : REM * RESPONSE ROUTINE
22120 IF RR$ = "N" THEN I$ = "N"
22130 PRINT
22140 PRINT"DO YOU WISH TO PRINT OUT THE ";CD$;" MESSAGE?"
22150 GOSUB 5000 : REM * RESPONSE ROUTINE
22160 IF RR$ = "N" THEN J$ = "N"
22170 PRINT
22180 REM * ACTIVATE PRINTER - DESIGNED FOR CBM PRINTERS
22190 OPEN 4,4
22200 CMD4
22210 PRINT:PRINTCHR$(1)"▨THE SECRET CODE MACHINE PRESENTS:■"
22220 PRINT
22230 IF G$ = "N" THEN GOTO 22260
22240 PRINT"THE ▨KEYWORD■ IS:";KE$
22250 PRINT
22260 IF H$ = "Y" THEN GOSUB 23000 : REM * MAGIC SQUARE PRINTOUT ROUTINE
22270 IF I$ = "N" THEN GOTO 22400
22280 PRINT"THE ORIGINAL MESSAGE:"
22290 PRINT
22300 IF LE < 30 THEN GOTO 22370
22310 FOR M = 1 TO INT(LE/30)
22320 :     FOR N = 1 TO 30
22330 :         PRINT ME$(N + M - 1);
22340 :     NEXT N
22350 :     PRINT
22360 NEXT M
22370 FOR N = 1 TO INT(LE - 30*INT(LE/30))
22380 :     PRINTME$(N + 30*INT(LE/30));
22390 NEXT N
22400 PRINT
22410 PRINT
22420 IF J$ = "N" THEN GOTO 22610
22430 PRINT"THE ";CD$;" MESSAGE IS:"
22440 PRINT
22450 IF LE < 30 THEN GOTO 22520
22460 FOR M = 1 TO INT(LE/30)
22470 :     FOR N = 1 TO 30
22480 :         PRINT MC$(N + M - 1);
22490 :     NEXT N
22500 :     PRINT
22510 NEXT M
22520 FOR N = 1 TO INT(LE - 30*INT(LE/30))
22530 :     PRINTMC$(N + 30*INT(LE/30));
22540 NEXT N
22600 PRINT
22610 PRINT#4
22620 CLOSE4
22630 PRINT
22640 RETURN : REM * TO 2120
22990 REM ******MAGIC SQUARE PRINTOUT***********************************
23000 PRINT"YOUR ▨MAGIC SQUARE■ IS:"
23020 PRINT
23030 FOR Y = 1 TO 5
23040 :     FOR X = 1 TO 5
23050 :         PRINT MS$(Y,X);" ";
23060 :     NEXT X
23065 PRINT
23070 NEXT Y
23080 PRINT
23090 RETURN : REM * BACK TO 22270
```

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dBase II	699.95	489.95
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Payroll	394.95	276.50
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Calc Star	144.95	101.95
Muse:		
Super Text Professionals	99.00	69.95
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Software Publishing Corporation:		
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16K RamCard	99.95	69.95
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S-100 MEMORY BOARDS

64K STATIC RAM - Jade

Uses new 2K x 8 static RAMs, fully supports IEEE 696 24 bit extended addressing, 200ns RAMs, lower 32K or entire board phantomable, 2716 EPROMs may be subbed for RAMs, any 2K segment of upper 8K may be disabled, low power typically less than 500ma.

MEM-99152B	*Bare board*	**$49.95**
MEM-99152K	*Kit less RAM*	**$99.95**
MEM-32152K	*32K kit*	**$199.95**
MEM-56152K	*56K kit*	**$289.95**
MEM-64152K	*64K kit*	**$299.95**
Assembled & Tested		**add $50.00**

256 RAMDISK - SD Systems

ExpandoRAM III expandable from 64K to 256K using 64K×1 RAM chips, compatible with CP/M, MP/M, Oasis, & most other Z-80 based systems, functions as ultra-high speed disk drive when used with optional RAMDISK software.

MEM-65064A	*64K A & T*	**$474.95**
MEM-65128A	*128K A & T*	**$574.95**
MEM-65192A	*192K A & T*	**$674.95**
MEM-65256A	*256K A & T*	**$774.95**
SFC-55009000F	*RAMDISK sftwr CP/M 2.2*	**$44.95**
SFC-55009000F	*RAMDISK with EXRAM III*	**$24.95**

64K RAM BOARD - C.C.S.

IEEE S-100, supports front panels, bank select, fail-safe refresh 4MHz, extended addressing, list price $575.00 - less than half price!!!

MEM-64565A	**$199.95**

LETTER QUALITY PRINTERS

LETTER QUALITY PRINTER - COMREX

Uses standard daisy wheels and ribbon cartridges, 16 CPS bi-directional printing, semi-automatic paper loader (single sheet or fan fold), 10/12/15 pitch, up to 16" paper, built-in noise suppression cover.

PRD-11001	*Centronics parallel*	**$899.95**
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PRA-11000	*Tractor Option*	**$119.95**

380Z by Data Terminals & Communications

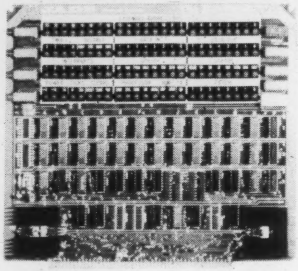
Based on the same quality mechanism as the Comrex printer the 380Z contains electronic enhancements that allow it to print at speeds up to 32 CPS. Other features include a 48K buffer, proportional spacing, and Diablo 1640/1650/630 compatible protocol. Comes with printwheel, ribbon and users manual. Serial, parallel, and IEEE 488 interfaces standard.

PRD-11300	*380Z printer*	**$1295.00**
PRA-11000	*Tractor option*	**$169.95**

32K PROM/RAM BOARD

The 32K S100 PROM/RAM board can hold up to 16 each 2716 style EPROMs, 6116 style RAMs, or 8 each style EPROMs. This board was designed to fit into older S100 systems as well as the newer IEEE-696 machines. Uses 5 volt only EPROM/RAMs, allows operation as a 2K to 32K board, meets IEEE-696 S100 proposed standard, addressable as two 16K blocks on any 64K page, supports Cromemco as well as Northstar bank select, perfect for MP/M systems.

MEM-99153B	*Bare board & manual*	**$49.95**
MEM-99153K	*Kit with No RAM*	**$89.95**
MEM-99153A	*A & T with No RAM*	**$139.95**
MEM-16153K	*Kit with 16K RAM*	**$129.95**
MEM-16153A	*A & T with 16K RAM*	**$179.95**
MEM-32153K	*Kit with 32K RAM*	**$179.95**
MEM—32153A	*A & T with 32K RAM*	**$229.95**
Call Us for Lowest Prices on EPROMs - 2732s		***$4.90***



S-100 I/O BOARDS

THE BUS PROBE - Jade

Inexpensive S-100 Diagnostic Analyzer

So your computer is down. And you don't have an oscilloscope. And you don't have a front panel... You're not alone - most computers have their occasional bad days. But without diagnostic equipment such as an oscilloscope (expensive!) or a front panel (expensive!), it can be very difficult to pinpoint the problem. Even if you have an extender board with a superfast logic probe, you can't see more than one signal at a time. You're stuck, right?

Not anymore; Jade is proud to offer our cost-effective solution to the problems mentioned above: ***THE BUS PROBE.***

Whether you're a hobbyist with a cantankerous kluge or a field technician with an anxious computer owner breathing down your neck, you'll find THE BUS PROBE speeds your repair time remarkably. Just plug in THE BUS PROBE and you'll be able to see all the IEEE S-100 signals in action. THE BUS PROBE allows you to see inputs, outputs, memory reads and writes, instruction fetches, DMA channels vectored interrupts, 8 or 16 bit wide data transfers, plus the three bus supply voltages.

TSX-200B	*Bare board*	**$59.95**
TSX-200K	*Kit*	**129.95**
TSX-200A	*A & T*	**$159.95**

I/O-4 - SSM Microcomputer

2 serial I/O ports plus 2 parallel I/O ports.

IOI-1010B	*Bare board w/manual*	**$35.95**
IOI-1010K	*Kit with Manual*	**$179.95**
IOI-1010A	*A & T*	**$249.95**

I/O-5 - SSM Microcomputer

Two serial & 3 parallel ports, 110-19.2K Baud

IOI-1015A	*A & T*	**$289.95**

INTERFACER 4 - CompuPro

3 serial, 1 parallel, 1 Centronics parallel.

IOI-1840A	*A & T*	**$314.95**
IOI-1830C	*CSC*	**$414.95**

S-100 EPROM BOARDS

PB-1 - SSM Microcomputer

2708, 2716 EPROM board with on-board programmer.

MEM-99510K	*Kit with manual*	**$154.95**
MEM-99510A	*A & T with manual*	**$219.95**

PROM-100 - SD Systems

2708, 2716, 2732 EPROM programmer with softrware.

MEM-99520K	*Kit with software*	**$189.95**
MEM-99520A	*A & T with software*	**$249.95**

DUAL DISK SUB-SYSTEMS

Disk Sub-Systems - Jade

Handsome metal cabinet with proportionally balanced air flow system, rugged dual drive power supply, power cable kit, power switch, line coard, fuse holder, cooling fan, never-mar rubber feet, all necessary hardware to mount 2-8" disk drives, power supply, and fan, does not include signal cable.

Dual 8" Sub-Assembly Cabinet

END-000420	*Bare cabinet*	**$49.95**
END-000421	*Cabinet kit*	**$199.95**
END-000431	*A & T*	**$249.95**

8" Sub-Systems - Single Sided, Double Density

END-000423	*Kit w/2 FD100-8Ds*	**$650.00**
END-000424	*A & T w/2 FD100-8Ds*	**$695.00**
END-000433	*Kit w/2 SA-801Rs*	**$999.95**
END-000434	*A & T w/2 SA-801Rs*	**$1195.00**

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END-000426	*Kit w/2 DT-8s*	**$1224.95**
END-000427	*A & T w/2 D-8s*	**$1424.995**
END-000436	*Kit w/2 SA-851Rs*	**$1274.95**
END-000437	*A & T w/2 SA-851Rs*	**$1474.95**

8" SLIMLINE SUB-SYSTEMS

Dual Slimline Sub-systems - Jade

Handsome vertical cabinet with scratch resistant baked enamel finish, proportionally balanced air flow system, quiet cooling fan, rugged dual drive power supply, power cables, power switch, line cord, fuse holder, cooling fan, all necessary hardware to mount 2-8" slimline disk drives, does not include signal cable.

Dual 8" Slimline Cabinet

END-000820	*Bare cabinet*	**$59.95**
END-000822	*A & T w/o drives*	**$179.95**

Dual 8" Slimline Sub-Systems

END-000823	*Kit w/2 SS DD*	**$919.95**
END-000824	*A & T w/2 SS DD*	**$949.95**
END-000833	*Kit w/2 DS DD*	**$1149.95**
END-000834	*A & T w/2 DS DD*	**$1179.95**

S-100 CPU BOARDS

SBC-200 - SD Systems

4 MHz Z-80A CPU with serial & parallel I/O, 1K RAM, 8K ROM space, monitor PROM included.

CPC-30200A	*A & T*	**$329.95**

THE BIG Z - Jade

2 or 4 MHz switachable Z-80 CPU board with serial I/O, accommodates 2708, 2716, or 2732 EPROM, baud rates from 75 to 9600.

CPU 30201B	*Bare board w/manual*	**$35.00**
CPU-30201K	*Kit with Manual*	**$149.95**
CPU-30201A	*A & T with Manual*	**$199.95**

2810 Z-80 CPU - C.C.S.

2 or 4 MHz Z-80 CPU with serial IO port & on board monitor PROM, front panel compatible.

CPU-30400A	*A & T with PROM*	**$289.95**

CPU-Z CompuPro

2 or 4 MHz Z80A CPU, 24 bit addressing.

CPU-30500A	*2/4 MHz A & T*	**$279.95**
CPU-30500C	*3/6 MHz CSC*	**$374.95**

8085/8088 - CompuPro

Both 8 & 16 bit CPUs, standard 8 bit S-100 bus, up to 8 MHz, accesses 16 Megabytes of memory.

CPU-20510A	*6 MHz A & T*	**$398.95**
CPU-20510C	*6/8 MHz CSC*	**$497.95**

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5 1/4 DISK DRIVES

Drive	Description	Part No.	Price	2 for
Tandon TM100-1	*single-sided double-density 48 TPI*	**MSM-551001**	$219.95 ea	**$199.95 ea**
Shugart SA400L	*single-sided double-density 40 track*	**MSM-104000**	$234.95 ea	**$224.95 ea**
Shugart SA455	*half-size double-sided 48 TPI*	**MSM-104550**	$349.95 ea	**$329.95 ea**
Shugart SA465	*half-size doule-sided 96 TPI*	**MSM-104650**	$399.95 ea	**$379.95 ea**
Tandon TM100-2	*double-sided double-density 48 TPI*	**MSM-551002**	$294.95 ea	**$269.95 ea**
Shugart SA450	*double-sided double-density 35 track*	**MSM-104500**	$349.95 ea	**$329.95 ea**
Tandon TM100-3	*single-sided double-density 96 TPI*	**MSM-551003**	$294.95 ea	**$269.95 ea**
Tandon TM100-4	*double-sided double-density 96 TPI*	**MSM-551004**	$394.95 ea	**$374.95 ea**
MPI B-51	*single-sided double-density 40 track*	**MSM-155100**	$234.95 ea	**$224.95 ea**
MPI B-52	*double-sided double-density 40 track*	**MSM-155200**	$344.95 ea	**$334.95 ea**

5¼" Cabinets with Power Supply

END-000216	*Single cab w/power supply*	**$69.95**
END-000226	*Dual cab w/power supply*	**$94.95**

S-100 MOTHERBOARDS

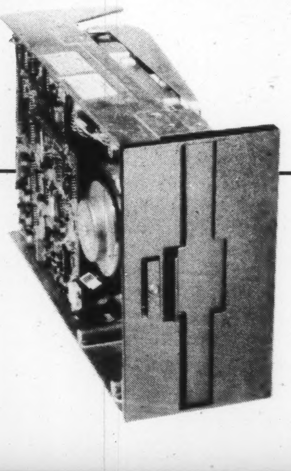
ISO-BUS - Jade

Silent, simple and on sale - a better motherboard.

6 Slot (5¼" x 8⅝")		
MBS-061B	*Bare board*	**$22.95**
MBS-061K	*Kit*	**$39.95**
MBS-061A	*A & T*	**$69.95**
12 Slot (9¾" x 8⅝")		
MBS-121B	*Bare board*	**$34.95**
MBS-121K	*Kit*	**$69.95**
MBS-121A	*A & T*	**$109.95**
18 Slot (14½" x 8⅝")		
MBS-181B	*Bare board*	**$54.95**
MBS-181K	*Kit*	**$99.95**
MBS-181A	*A & T*	**$149.95**

8" DISK DRIVES

Drive	Description	Part No.	Price	2 for
Siemens FDD 100-8	*single-sided double-density*	**MSF-201120**	*$274.95 ea*	**$249.95 ea**
Shugart SA801R	*single-sided double-density*	**MSF-10801R**	$394.95 ea	**$389.95 ea**
Shugart SA851R	*double-sided double-density*	**MSF-10851R**	$554.95 ea	**$529.95 ea**
Qume DT-8	*double-sided double-density*	**MSF-750080**	$524.95 ea	**$498.95 ea**



MODEMS

SMART BUY in MODEMS - Signalman

1200 and/or 300 baud, direct connect, automatic answer or originate selection, auto-answer/auto-dial on deluxe models. 9v battery allows total portability, full one year warranty.

IOM-5600A	*300 baud direct connect*	**$89.95**
IOM-5610A	*300 baud Deluxe*	**$149.95**
IOM-5620A	*1200/300 baud Deluxe*	**$369.95**
IOM-5650A	*300 baud for Osborne*	**$119.95**

SMARTMODEM - Hayes

Sophisticated direct-connect auto-answer/auto-dial modem, touch-tone or pulse dialing. RS-232C interface, programmable.

IOM-5400A	*Smartmodem*	**$224.95**
IOK-1500A	*Hayes Chronograph*	**$218.95**
IOM-1100A	*Micromodem 100*	**$368.95**

1200 BAUD SMARTMODEM - Hayes

1200 and 300 baud. all the features of the standard Smartmodem plus 1200 baud. 212 compatible. full or half duplex.

ICM-5500A	*Smartmodem 1200*	**$599.95**

1200 BAUD SMART CAT - Novation

103/212 Smart Cat & 103 Smart Cat. 1200 & 300 baud. built-in dialer. auto re-dial if busy. auto answer/disconnect. direct connect. LED readout displays mode. analog/digital loop-back self tests. usable with multi-line phones.

IOM-5241A	*300 baud 103 Smart Cat*	**$229.95**
IOM-5251A	*1200 baud 212/103 Smart Cat*	**$549.95**

J-CAT™ MODEM - Novation

1/5 the size of ordinary modems, Bell 103, manual or auto-answer, automatic answer/originate, direct conect, built-in self-test, two LED's and audio "beeps" provide complete status information.

IOM-5261A	*Novation*	**$149.95**

S-100 DISK CONTROLLERS

DISK 1- CompuPro

8" or 5¼" DMA disk controller, single or double density, single or double sided, 10MHz.

IOD-1810A	*A & T*	**$449.95**
IOD-1810C	*CSC*	**$554.95**

VERSAFLOPPY II - SD Systems

Double density disk controller for any combination of 5¼" and 8" single or double sided, analog phase-locked loop data separator, vectored interrupts. CP/M 2.2 & Oasis compatible, contro/diagnostic software PROM included.

IOD-1160A	*A & T with PROM*	**$359.95**
SFC-55009047F	*CP/M 3.0 with VF-II*	**$139.95**

2422 DISK CONTROLLER - C.C.S.

5¼" or 8" double density disk controller with on-board boot loader ROM, free CP/M 2.2 & manual set.

IOD-1300A	*A&T with CP/M 2.2*	**$399.95**

DOUBLE D - Jade

High reliability double density disk controller with on-board Z-80A, auxiliary printer port, IEEE S-100 can function in multi-user interrupt driven bus.

IOD-1200B	*Bare board & hdwr man*	**$59.95**
IOD-1200K	*Kit w/hdwr & sftwr man*	**$299.95**
IOD-1200A	*A & T w/hdwr & sftwr man*	**$325.95**
SFC-59002001F	*CP/M 2.2 with Double D*	**$99.95**

EPROM ERASERS

ULTRA-VIOLET EPROM ERASERS

Inexpensive erasers for industry or home.

XME-3100A	*Spectronics w/o timer*	**$69.50**
XME-3101A	*Spectronics with timer*	**$94.95**
XME-3200A	*Logical Devices*	**$49.95**

SINGLE BOARD COMPUTER

SUPERQUAD - Adv. Micro Digital

Single board, standard size S-100 computer system, 4 MHz Z-80A, single or double density disk controller for 5¼" or 8" drives, 64K RAM, extended addressing, up to 4K of EPROM, 2 serial & 2 parallel I/O ports, real time interrupt clock, CP/M compatible.

CPC-30800A	*A & T*	**$724.95**
IOX-4232A	*Serial I/O adapter*	**$29.95**

NEW! CP/M PLUS 3.0

CP/M 3.0 is Didital Research's latest version of the industry standard disk operating system. It features many performance improvements, such as intelligent record buffering, improved directory handling, "HELP" facility, time/date stamping of files and many more improvements. AND A TREMENDOUS INCREASE IN SPEED!!!, it is fully CP/M 2.2 compatible and requires no changes to your existing application software. Available only to Versafloppy II owners with CBC-200 CPU's.

- ***CP/M compatible***
- ***Easily customized***
- ***Easier to learn and use***
- ***High performance file system***
- ***Automatic disk log-in of removable media***
- ***Support for 1 to 16 banks of RAM***
- ***Supports up to 16 drives of 512 Megabytes each***
- ***Up to ten times faster than CP/M 2.2***
- ***Console I/O re-direction***
- ***Easy to use system utilities with HELP facility***
- ***Powerful batch facility***
- ***Designed for application programmers***
- ***Resident system extensions***

SFC-55009057F	*CP/M 3.0 8" with manual*	**$200.00**
SFC-55009057M	*CP/M 3.0 Manual*	**$40.00**

THREE BOARD SET - SD Systems

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Basic Cryptography: SBOEPN DJQIFST

Daniel D. Wheeler and Elisheva Perri

The personal computer is a powerful tool for cryptography. With a bit of simple programming you can encipher secret messages to your friends so securely that it would take the efforts of a mathematical cryptographer to unravel the system. But with the proper keyword a friend can use his computer to decipher and read your message.

There have been several programs for simple cryptography published in the major computer magazines. Some of these programs, unfortunately, have used very weak systems for enciphering the messages. Anyone with a little knowledge of cryptanalytic techniques could break the system and read the messages without knowing the keyword.

This article explains the principles of computer cryptography and demonstrates the use of the Basic random number function for enciphering messages. Versions of the program are included for the Apple II, the TRS-80 Models I and III, IBM PC, and the Atari 400 and 800.

Cryptography by Addition

Letters are represented in computers as numbers. This makes it easy to use the arithmetic operations of Basic to transform the letters. The simplest system is just to add a constant number to the character code for each letter. If the result is too large, subtract the number of characters being used so that the result is again a valid character code. Suppose, for instance, that you want to use three as the constant and that your messages consist of only capital letters. Then each letter in the message will come out as the letter three letters further on in the alphabet. The letter A (ASCII code 65) will appear as D (ASCII code 68), B (66) becomes E (69), and so forth. At the end of the alphabet, X (88) becomes the ASCII code 91. But 90 is Z and 91 is beyond the end of the alphabet. So 26 (the number of characters we are using) is subtracted from 91 to produce 65. Thus X wraps around to the beginning of the alphabet and becomes A.

The Basic statements necessary to do this are quite simple. If the letter to be transformed is stored in the string A$, you can do it with:

```
100 X = ASC( A$ )
110 X = X + 3
120 IF X > 90 THEN X = X - 26
130 A$ = CHR$( X )
```

The ASC(A$) function converts the character to a numeric variable so that the arithmetic can be done in the next two statements. The CHR$(X) function converts the numeric result back into a string.

To decipher the message, change lines 110 and 120 to:

```
110 X = X - 3
120IF X < 65 THEN X = X + 26
```

This system is called a Caesar cipher because Julius Caesar is said to have used it. It may have fooled the Gauls, but now any bright elementary school student (maybe with a hint) can break the system. Part of the title of this article is in the Caesar cipher, but not with an offset of three.

Better Systems

The weakness of the system comes from the use of the constant. There are only 25 possible constants to try and once you figure it out it is easy to decipher the whole message. You can improve the system by changing the offset for each character. You might try adding one to the offset each time you encipher a character and then subtracting 26 from the constant whenever it gets too large. This will produce a cipher that is much more difficult to break.

There are many possible schemes for changing the offset. Any scheme will work to make the cipher more difficult to break. But if the scheme is simple (like adding one) and repeats at fairly short, regular intervals, then it is not very difficult to figure out the pattern and break the cipher. A smart high school student could do it.

What you need is an irregular pattern that doesn't repeat within the length of the messages you are interested in sending. The random number function in Basic provides a very irregular series of numbers. They do repeat eventually, but the cycle is much longer than any messages you will ever send on your computer.

If the random number function were truly random, it would not be useful for our purpose. Once you have enciphered a message, your recipient must be able to generate the same sequence of numbers to decipher the message. Fortunately, most versions of Basic provide some way to "seed" the random function so that it generates the same sequence of numbers.

In Applesoft, for instance, calling the random number function with a negative argument, such as RND (-99), seeds the

---

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Cryptography, continued...

Listing 1. Apple II version of the random cipher program.

```
10 REM DEMONSTRATION OF RANDOM ENCIPHERING ON THE APPLE II
20 REM BY DANIEL D. WHEELER AND ELISHEVA PEERI
30 DIM IN%(255)
40 HOME
90 REM
100 REM INITIALIZATION OF RND() FUNCTION
110 INPUT "ENTER A NEGATIVE NUMBER: ";N
120 IF N > -1 THEN 110
130 X = RND (N)
190 REM
200 REM SELECT ENCIPHER OR DECIPHER
210 PRINT "SELECT (1) ENCIPHER OR (2) DECIPHER"
220 INPUT "ENTER 1 OR 2: ";CH
230 IF CH < 1 OR CH > 2 THEN 220
290 REM
300 REM INPUT MESSAGE
310 PRINT "ENTER YOUR MESSAGE:"
320 I = 1
330 GET A$: PRINT A$;
340 IF A$ = CHR$ (13) THEN 380
350 IN%(I) = ASC (A$)
360 I = I + 1
370 GOTO 330
380 ON CH GOTO 400,500
390 REM
400 REM ENCIPHER THE MESSAGE
410 FOR J = 1 TO I - 1
420 X = IN%(J) + INT ( RND (1) * 59)
430 IF X > 90 THEN X = X - 59
440 PRINT CHR$ (X);
450 NEXT J
460 END
500 REM DECIPHER THE MESSAGE
510 FOR J = 1 TO I - 1
520 X = IN%(J) - INT ( RND (1) * 59)
530 IF X < 32 THEN X = X + 59
540 PRINT CHR$ (X);
550 NEXT J
560 END
```

Listing 2. TRS-80 version of the random cipher program.

```
10 REM DEMONSTRATION OF RANDOM ENCIPHERING ON THE TRS-80
20 REM BY DANIEL D. WHEELER AND ELISHEVA PEERI
30 DIM IN%(255)
40 CLS
90 REM
100 REM INITIALIZATION OF RND() FUNCTION
110 INPUT "ENTER A NUMBER BETWEEN 1 AND 32767: ";N
120 IF N<1 OR N>32767 THEN 110
130 POKE 16554,0
140 POKE 16555,INT(N/256)
150 POKE 16556,N-INT(N/256)*256
190 REM
200 REM SELECT ENCIPHER OR DECIPHER
210 PRINT "SELECT (1) ENCIPHER OR (2) DECIPHER"
220 INPUT "ENTER 1 OR 2: ";CH
230 IF CH<1 OR CH>2 THEN 220
290 REM
300 REM INPUT MESSAGE
310 PRINT "ENTER YOUR MESSAGE:"
320 I=1
330 A$=""
340 A$=INKEY$:IF A$="" THEN 340
350 PRINT A$;:IF A$=CHR$(13) THEN 390
360 IN%(I)=ASC(A$)
370 I=I+1
380 GOTO 330
390 ON CH GOTO 400,500
395 REM
400 REM ENCIPHER THE MESSAGE
410 FOR J=1 TO I-1
420 X=IN%(J)+RND(59)
430 IF X>90 THEN X=X-59
440 PRINT CHR$(X);
450 NEXT J
460 END
500 REM DECIPHER THE MESSAGE
510 FOR J=1 TO I-1
520 X=IN%(J)-RND(59)
530 IF X<32 THEN X=X+59
540 PRINT CHR$(X);
550 NEXT J
560 END
```

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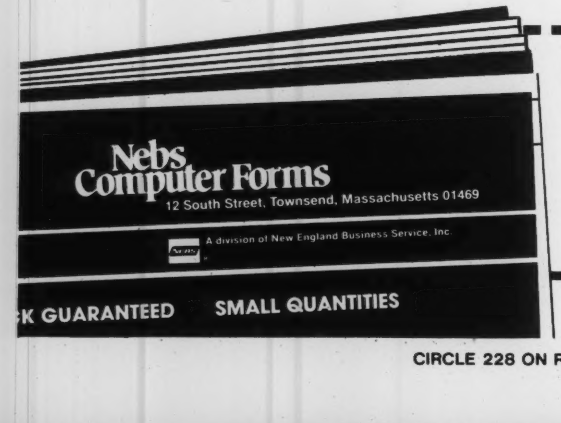

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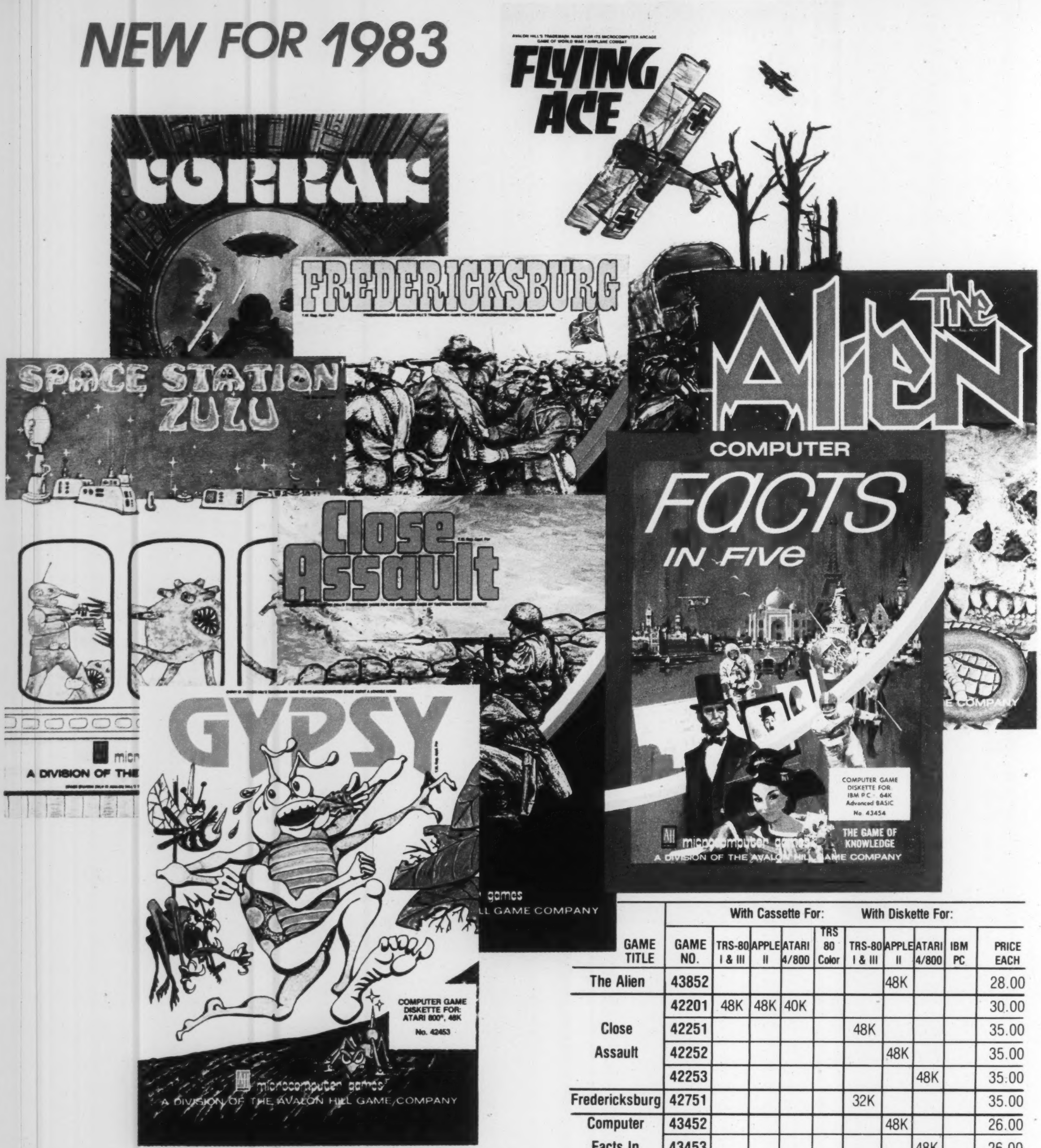
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Listing 3. Atari version of the random cipher program.

```
10 REM DEMONSTRATION OF RANDOM ENCIPHERING ON THE ATARI
20 REM BY DANIEL D. WHEELER AND ELISHEVA PEERI
30 DIM IN(255),A$(255)
40 PRINT CHR$(125): REM CLEAR SCREEN
90 REM
100 REM INITIALIZATION
110 PRINT "ENTER A NUMBER BETWEEN 1 AND 99999:"
120 INPUT CH
130 IF N<1 OR N>99999 THEN 110
140 N=N/100000
190 REM
200 REM SELECT ENCIPHER OR DECIPHER
210 PRINT "SELECT (1) ENCIPHER OR (2) DECIPHER"
220 PRINT "ENTER 1 OR 2: ";:INPUT CH
230 IF CH<1 OR CH>2 THEN 220
290 REM
300 REM INPUT MESSAGE
310 PRINT "ENTER YOUR MESSAGE:"
320 INPUT A$
330 L=LEN(A$)
340 FOR I=1 TO L
350 IN(I)=ASC(A$(I))
360 NEXT I
370 ON CH GOTO 400,500
390 REM
400 REM ENCIPHER THE MESSAGE
410 FOR J=1 TO I-1
420 N=N*997-INT(N*997)
430 X=IN(J)+INT(N*59)
440 IF X>90 THEN X=X-59
450 PRINT CHR$(X);
460 NEXT J
470 END
500 REM DECIPHER THE MESSAGE
510 FOR J=1 TO I-1
520 N=N*997-INT(N*997)
530 X=IN(J)-INT(N*59)
540 IF X<32 THEN X=X+59
550 PRINT CHR$(X);
560 NEXT J
570 END
```

Listing 4. IBM PC version of the random cipher program.

```
10 REM RANDOM ENCIPHERING ON THE IBM PC
20 REM FROM WHEELER AND PEERI. TRANSLATED BY JOHN ANDERSON
30 DIM IN%(255)
40 CLS
50 REM MAKE SURE CAPS LOCK IS IN ALL CAPS POSITION
90 REM
100 REM INITIALIZATION OF RANDOM FUNCTION
110 RANDOMIZE
120 REM THAT'S ALL YOU NEED TO SAY. PC TAKES IT FROM HERE.
190 REM
200 REM SELECT YOUR MODE
210 PRINT"Select (1) encipher or (2) decipher"
220 INPUT "Enter 1 or 2 ";CH
230 IF CH <1 OR CH>2 THEN 220
290 REM
300 REM INPUT MESSAGE
310 PRINT"Enter your message:"
320 I=1
330 A$=""
340 A$=INKEY$:IF A$="" THEN 340
350 PRINT A$;:IF A$=CHR$(13) THEN 390
360 IN%(I)=ASC(A$)
370 I=I+1
380 GOTO 330
390 ON CH GOTO 400,500
395 REM
400 REM ENCIPHER THE MESSAGE
410 FOR J=1 TO I-1
420 X=IN%(J)+(INT(RND*59))
430 IF X>90 THEN X=X-59
440 PRINT CHR$(X);
450 NEXT J
460 END
490 REM
500 REM DECIPHER THE MESSAGE
510 FOR J=1 TO I-1
520 X=IN%(J)-(INT(RND*59))
530 IF X <32 THEN X=X+59
540 PRINT CHR$(X);
550 NEXT J
560 END
```

generator to start at a definite place in the sequence. If you agree beforehand on a number to use as the seed, your friend will be able to decipher your message by generating the same sequence of numbers to use as offsets.

Demonstration Programs

Listings 1, 2, 3, and 4 show programs to demonstrate these techniques for four popular microcomputers. Each of the programs enciphers or deciphers a one-line secret message. Instead of enciphering just the letters of the message, these programs encipher everything: letters, numbers, punctuation marks and even spaces. (The ASCII code for the space is 32. It is just as much a character as any of the others. You must be especially careful in typing the enciphered message to get all the spaces exactly right.)

The program lines in the 100's initialize the random number generator. For the Apple this is simply a matter of calling the random number generator with a negative argument. The variable X in line 130 is included only to make a complete statement; the value stored in X is never used.

Setting the random number seed on the IBM PC is a trivial process, as the RANDOMIZE function allows automation of the seed generation. By omitting an argument in the RANDOMIZE command in line 110, the PC will return with the default input statement, Random Number Seed (-32768 to 32767)? You may then input your cipher base value. The message is input with an INKEY command, so backspacing is impossible. It should also be noted that messages for enciphering must be input in upper case, for proper decoding. The rest of the program follows other Microsoft versions closely.

There is no instruction to initialize the RND() function in TRS-80 Level II Basic, but it can be done with POKEs into memory. Lines 130-150 show how to do it. POKEs can only be done with numbers smaller than 256. The instructions in lines 140 and 150 break the larger seed (stored in N) into two parts, each less than 256.

We couldn't figure out how to seed the RND() function in Atari Basic, so we'll show you how to write your own random function. The initial seed must be a decimal fraction between zero and one. In lines 110-140 the program gets a number and then divides by 100,000 to make it a fraction.

The lines in the 200's allow you to select whether the message will be enciphered (by adding the random numbers) or deciphered (by subtracting the random numbers).

The next section of the program (300's) allows you to enter your message. For the Atari this is a straightforward INPUT statement. Then the loop in lines 340-360 converts the characters to the numeric (ASCII code) values and stores them in the array IN(). But neither the Apple nor the TRS-80 allows commas within input strings. The comma is used to separate multiple items in the input. Since we wanted to include the comma as an allowable character we used the single character input commands. These are GET on the Apple and INKEY$ on the TRS-80. The program loop starting at line 330 accepts single characters, converts them to numeric form, and stores the ASCII codes in the integer array IN%().

When the message is completely entered, the program goes to the section either to encipher (400's) or decipher (500's) the message. There are 59 possible characters from "space" (ASCII 32) to Z (ASCII 90). To encipher the message we should add a random integer up to 59 to each of the character codes. This is easy on the TRS-80.

The RND() function with arguments larger than one returns integers in the range from one to the value of the argument. Thus RND(59) returns integers from 1 to 59. These are added to the character codes in line 420. Line 430 subtracts 59 if the result is out of the allowable range. Line 430 converts the numeric code to a character and prints it. The loop in lines 410-450 repeats this for each character in the message.

The Apple RND() function returns decimal fractions between zero and one.

Cryptography, continued...

Sample Run.

```
Random number seed (-32768 to 32767)? 134
Select (1) encipher or (2) decipher
Enter 1 or 2 ? 1
Enter your message:
THE WHEAT IS SEPARATED FROM THE CHAFF. ACT ACCORDINGLY. BONAPARTE.
T=%650J7/#NTA9/3D3=A)XH*E(:O6G3.QL*L:)SR+D#E'!C9à+J%G.&97 !0N<F 6$
Ok¬
```

To convert to a random integer we multiply by 59 and use the INT() function to make the result an integer. This appears in line 420. The rest of the loop is exactly the same as for the TRS-80.

In the Atari version we don't use the built-in RND() function. We store the seed for our own random function in the variable N. To get each successive random number we multiply N by 997 and take the fractional part of the result to use as the random number and to store in N for generating the next number. Line 420 does this by calculating 997*N and subtracting the integer part to leave the fractional part. Then N is used in line 430 as a random number in the range zero to one, just as in the Apple version.

The section to decipher the message (lines in the 500's) is exactly the same as the enciphering section except that the additions and subtractions are reversed. It will restore an enciphered message to its original form.

Extending the Demonstration Programs

These demonstration programs are not intended for practical use. They can, however, be extended to meet your cryptographic needs. You will certainly want to put in a loop so that your messages can be more than one line long. You will probably want the output written on disk or cassette so the person receiving your message won't have to type the random-appearing enciphered text. Output to a modem for telephone communication is another possibility. Your imagination is the only limit.

Breaking Random Ciphers

You might think that the ciphers based on random number generators would be impossible to break. After all, the enciphered message looks just like a random sequence of characters. There is no pattern to give clues to the content of the message. During World War II the Germans were confident that their machine cipher was secure. But first the Poles and then the British were able to break it. Churchill was reading Hitler's war dispatches—sometimes even before they got to Hitler.

The method requires that the cryptographer be able to guess a word in the message. For instance, if the message looks as though it was intended as a letter, it is likely to begin "Dear . . ." The cryptographer subtracts the ASCII codes for "Dear" from the message to recover part of the sequence of the random number generator. It is possible to figure out from a few numbers where the random number generator is in its sequence. Then it is a simple matter to generate the entire sequence and decipher the whole message. If the first attempt doesn't work, the cryptographer tries other probable words in all possible positions in the message.

There are techniques for enciphering messages that are resistant to the probable word method. If you have a serious security problem you should get a commercially available, tested system. But for most personal computer users the ciphers based on the Basic random function provide a reasonable degree of security. Unless your lover's spouse is a mathematician, you'll be able to keep your letters secret with Basic random ciphers. ☐

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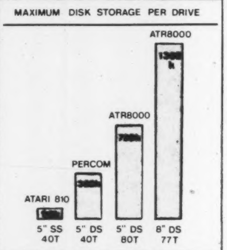

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ATARI 810	x	NO	x[1]	NO	NO	EXTRA[2]	EXTRA[2]	NO	NO	NO	NO
PERCOM	x	x	x	NO	NO	EXTRA[2]	EXTRA[2]	NO	NO	NO	NO

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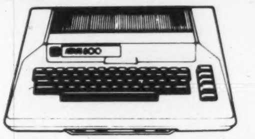

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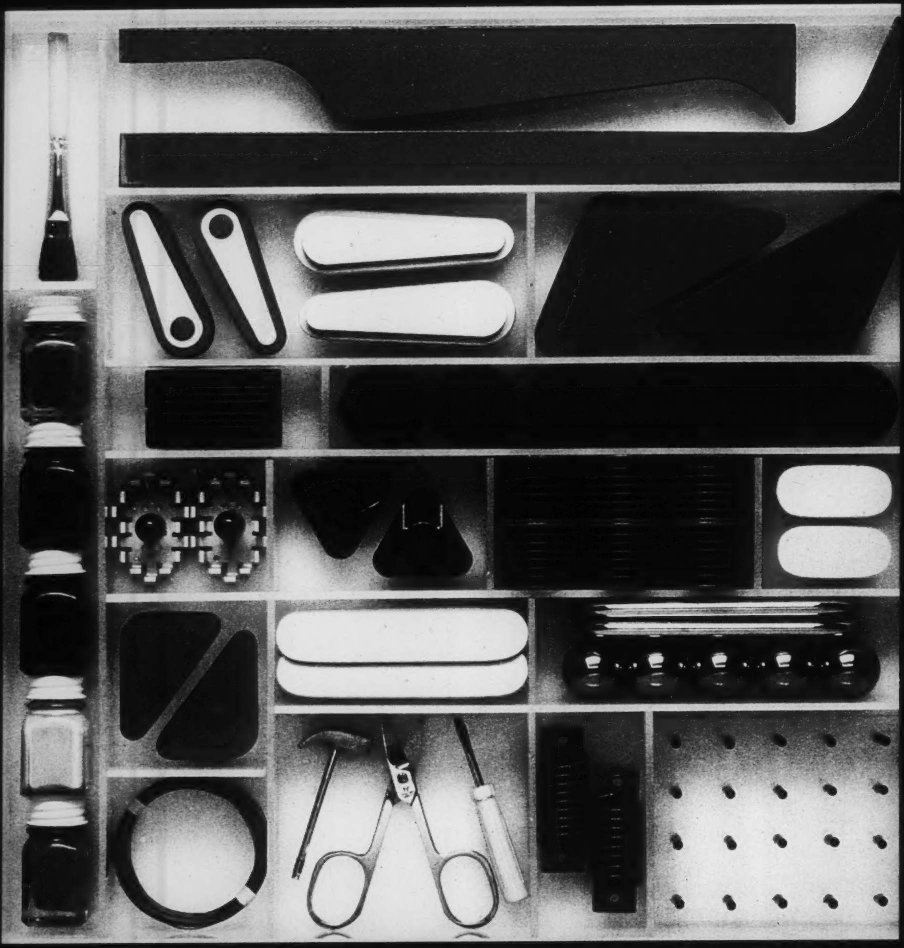

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Lock up your data with a public key

The Trapdoor Algorithm

David Block

Methods of secret writing have been used for centuries to keep communications secure from prying eyes. And for centuries men have been devising means to break the locks, to tear the secrets from these cryptic messages. The first practical electronic computers, the British series called Colossi, were special purpose devices which were used successfully during World War II to decipher the German *Geheimschreiber* and Enigma messages.

When Alan Turing visited the United States electronic computer EDVAC, the men who proudly explained its workings to him had no idea that he had been working with a functioning computer for years. The secrecy which cloaked that British project continues to this day. From the small amount of information which has been released we can only guess that the operation of the machine involved heuristic methods; the actual decrypting consisted of a search for patterns by the computer, with that search being guided by the operator into paths indicated by intermediate results of the search. This synergistic relationship of man and computer, the truest and best use of these electronic giants, combines the speed and accuracy of digital circuitry with the incredible powers of the human brain. The German cipher machines could not withstand that attack.

It has long been considered axiomatic that no cipher is secure against a determined attack; consequently the publication of the method called the trapdoor algorithm took the cipher experts by surprise. Professor Donald Knuth reports (*Seminumerical Algorithms,* second edition, p. 386) that this method was discovered by R.L. Rivest, A. Shamir, and L. Adleman in 1977. A trapdoor algorithm is a mathematical function which goes in only one direction. In the case of ciphers, it is the rules for making a ciphered message, rules which do not tell you how to decipher the message. This article will explain how the method is applied and give a worked example, along with Basic programs useful in cryptography.

A practical advantage of the method is that the keys used to make the cipher can be public knowledge. Your agent in a foreign country does not have to memorize the keys but can write them down, since it will not help the enemy to discover them. A serious disadvantage of the method is that it requires for security that the keys be very large numbers. This means that a special computer program is necessary.

The arithmetic of the algorithm can be explained in a few words. You will remember that we are dealing throughout with only whole, positive numbers. First, the process of exponentiation, or raising a number to a power, is just multiplying a number by itself several times. For example, 5 times 5 times 5 is equal to 125. That is called raising 5 to the third power.

Second, the process of modulating a number is just finding the remainder after another number has been subtracted as many times as possible from the first number. Thus 9 mod 2 is 1; 27 mod 12 is 3. If your Basic doesn't have the MOD function, you can do it in one line:

```
50 IF A > B then A=A-B: GOTO 50:
REM A becomes A mod B
```

Third, prime numbers are only those numbers which are measured only by themselves and by 1. Nine can be measured by 3 (divided into 3's with no remainder) so it is not prime. Twenty-nine cannot be divided evenly into any smaller number of groups, so 29 is a prime number. (As an aside, consider the illogicality of saying that 3 divided into 9 is 3. On reflection it is apparent that what is meant is that 9 can be divided into 3 groups of 3.)

Now we are ready for the trapdoor algorithm. Take two prime numbers, which we shall name P and Q. Multiply these numbers and call the result N. Now subtract one from P and one from Q. Call this new pair R and S, and find their greatest common divisor (GCD), the largest number which measures each of them evenly.

The next step is to multiply the GCD by the product of R and S. The result of adding one to this product may, surprisingly enough, turn out to be the product of another pair of prime numbers. Call this new pair D and E. One of these numbers is your private key, D. The other number and N make up your public key.

To send a message to someone, convert the message into groups of numbers. Then raise each group to the E power and modulate it with his N. When he receives the cipher he will divide it into groups, raise each group to his D power and modulate with N. It will then be a simple matter for him to convert the resulting numbers back into the original message.

The reason this is called the trapdoor algorithm is that when the numbers chosen are sufficiently large, it is practically impossible to calculate D, even though you know what E and N are. In this case sufficiently large has been defined as numbers containing 200 digits. To calculate D would require factoring N, a process which would take over three million years worth of CPU time on a Cray-1 computer. Thus Messers Rivest, Shamir, and Adelman have come up with a method of encrypting messages via computer which depends for its security only upon safeguarding the private key, D.

There have been indications that publication of research on advances in ciphers has been discouraged by government agencies. In the case of this trapdoor algorithm an additional difficulty has been the fact that the high precision arithmetic required, calls for computer

David Block, P.O. Box 12473, Gainesville, FL 32604.

Trapdoor Algorithm, continued...

programs not generally available. The development of the following trivial example was possible through the use of special abilities of the muMath/muSimp program. That program was developed by Albert Rich and David Stoutmeyer of The Software House in Honolulu and is distributed by Microsoft in versions for CP/M, Apple II, and TRS-80 Models I and III. A practical example with a 200-digit N could be worked out in a reasonably, short time only by using a large mainframe computer with a computer algebra program. MuMath is reviewed in detail in the October '82 issue of **Creative Computing.**

Although the muMath program can work with numbers containing over 600 digits, the pair of prime numbers we start with must be small because, as we shall see, the intermediate steps in the algorithm will produce numbers much larger than the primes we start with. We begin our example by generating the prime numbers between 2 and 100, using the Basic program in Listing 1.

This is an implementation of the process called the Sieve of Eratosthenes, based on that ancient Greek mathematician's observation that multiples of prime numbers cannot themselves be prime numbers. (The Greek mathematicians did not consider 1 to be a number and of course did not admit the existence of 0. How can nothing exist?)

The table, which contains intermediate results as well as the pair of keys associated with each candidate for N, shows us that several combinations of the prime numbers we are investigating are unusable. Several pairs, such as 19 and 29, do not produce keys. Other pairs, such as 19 and 37, produce a key so large that we cannot handle it with muMath. The result of raising 999 to the 2333 power is a number containing almost 7000 digits. We shall choose the pair of keys, 37, 109, resulting from the pair of primes 29, 37.

The message to be enciphered must be transformed into numbers. We shall assign two-digit values to the letters: A=11, B=12, . . ., Z=36. Spaces will be given the value 37. See Figure 1. (In an actual case, a more secure cipher

Listing 1.

```
10  A=1:I=A
15  REM: Set up an array representing one to one hundred.
20  DIM A(100)
30  N=10
40  I=I+A
50  IF A(I)=A THEN 40 ELSE IF I)N THEN 100
55  REM: Label every multiple of I with a one.
60  FOR J=I+I TO 100 STEP I
70  A(J)=A
80  NEXT J
90  GOTO 40
95  REM: Print out the unlabeled numbers.
100 FOR K=2 TO 100
110 IF A(K)=0 THEN PRINT K;
120 NEXT K
130 END
```

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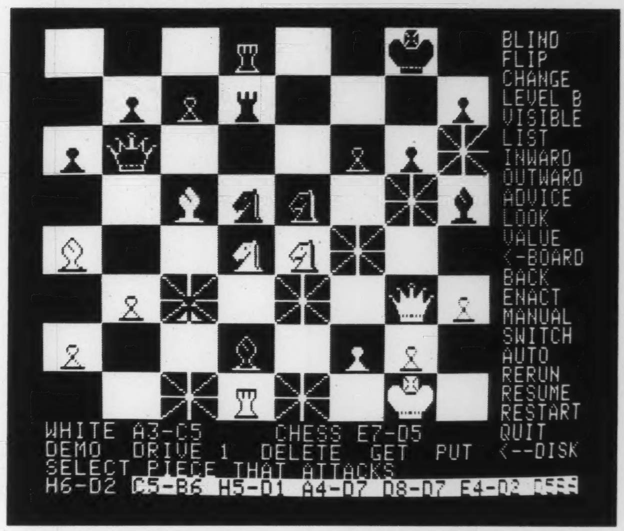
BLIND
FLIP
CHANGE
LEVEL B
VISIBLE
LIST
INWARD
OUTWARD
ADVICE
LOOK
VALUE
<-BOARD
BACK
ENACT
MANUAL
SWITCH
AUTO
RERUN
RESUME
RESTART
QUIT
<--DISK

```
WHITE A3-C5       CHESS E7-D5
DEMO  DRIVE 1  DELETE  GET  PUT
SELECT PIECE THAT ATTACKS
H6-D2 C5-B6 H5-D1 A4-D7 D8-D7 E4-D2 [illegible]
```

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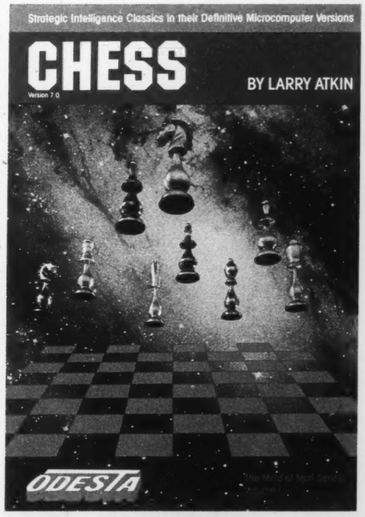
One of U.S. Othello Assoc.'s top-ranked players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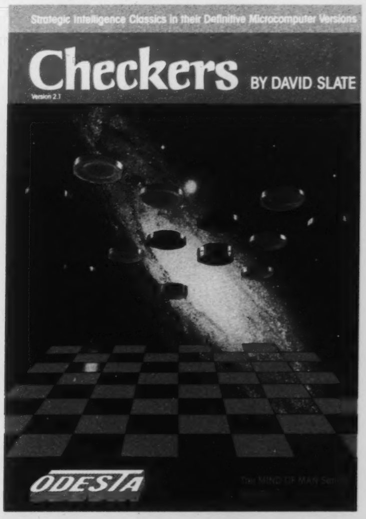
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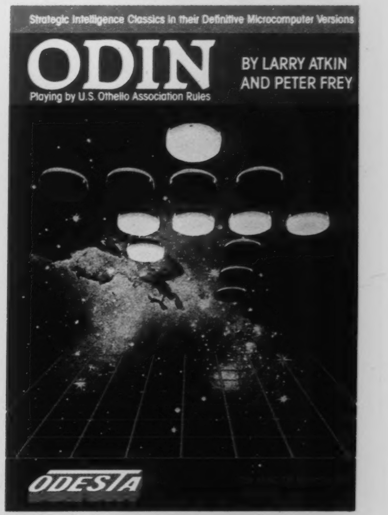
Strategic Intelligence Classics in their Definitive Microcomputer Versions
ODIN
Playing by U.S. Othello Association Rules
BY LARRY ATKIN AND PETER FREY
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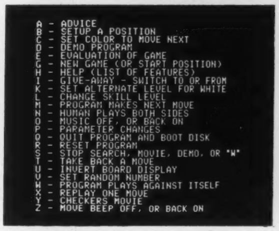
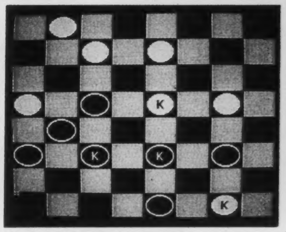
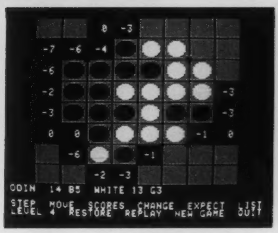


```
A - ADVICE
B - SETUP A POSITION
C - SET COLOR TO MOVE NEXT
D - DEMO PROGRAM
E - EVALUATION OF GAME
G - NEW GAME (OR START POSITION)
H - HELP (LIST OF FEATURES)
I - GIVE-AWAY - SWITCH TO OR FROM
K - SET ALTERNATE LEVEL FOR WHITE
L - CHANGE SKILL LEVEL
M - PROGRAM MAKES NEXT MOVE
N - HUMAN PLAYS BOTH SIDES
O - MUSIC OFF, OR BACK ON
P - PARAMETER CHANGES
Q - QUIT PROGRAM AND BOOT DISK
R - RESET PROGRAM
S - STOP SEARCH, MOVIE, DEMO, OR "W"
T - TAKE BACK A MOVE
U - INVERT BOARD DISPLAY
V - SET RANDOM NUMBER
W - PROGRAM PLAYS AGAINST ITSELF
X - REPLAY ONE MOVE
Y - CHECKERS MOVIE
Z - MOVE BEEP OFF, OR BACK ON
```

Checkers' features

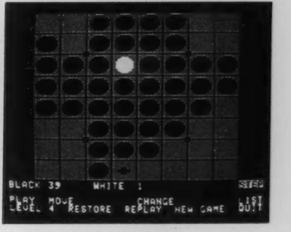


Black to move and win
(From Checkers documentation)


0
-3
-7
-6
-4
-6
-2
-3
-3
-3
0
0
-1
0
-6
-1
-2
-3

```
ODIN  14 B5  WHITE 13 G3
STEP  MOVE  SCORES  CHANGE  EXPECT  LIST
LEVEL 4  RESTORE  REPLAY  NEW GAME  QUIT
```

"Scores" feature in Odin



```
BLACK 39    WHITE  1                STEP
PLAY  MOVE          CHANGE           LIST
LEVEL 4  RESTORE  REPLAY  NEW GAME   QUIT
```

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CIRCLE 168 ON READER SERVICE CARD

would be obtained by not using a regular order for numbering the letters.)

Listing 3 can be used to do the conversion, but we must now abandon Basic because the precision arithmetic required would call for slow and complicated Basic programs.

Working With muMath

Figures 2 and 3, which show muMath at work, require a little explanation. The machine prompt, the symbol telling the operator that the program is waiting for a command, is the question mark. The operator uses a colon for assignment and a semicolon to request a printout, with a left bracket to indicate exponentiation. The commercial at symbol (@) is a variable equal to the last answer the machine gave.

Figure 1.

```
C   O   M   E       H   O   M   E       E   T
13  25  23  15  37  18  25  23  15  37  15  30
132     523 153     718 252     315 371     530
```

Figure 2.

```
   D:37;E:109;N:1073;
@: 37


? @: 109


? @: 1073


? 132[D;
@:

289224750177183227558122231949191437419911681339284019128060958

0272599886200832


? MOD(@,N);
@: 169


? 169[E;
@:

691274923611494487506935190275674518754102142159505486469575983

897862558301410522788850470569636823308772505594223920522776430

579174796174758156068348444012813870652591728984884069778523785

097207349030191594180374014910139398996767476956645129


? MOD(@,N);
@: 132


?
```

Figure 2 shows the process of enciphering and deciphering the first group, 132, in detail. The first four lines show the values muMath has been given for D, E, and N. Lines 7 and 8 show that raising 132 to the 37th power yields a 79-digit number, which is then reduced mod 1073 to the cipher group 169. The work sheet goes on to reverse the process, calculating the 243-digit result of raising the code group 169 to the 109th power, then reducing that answer mod 1073 to 132, thereby recovering the original message group.

Figure 3 shows the process applied to the entire message in a more compact form, without printing out the intermediate values.

This example of ciphering shows the mathematical operations of the method, but the short key numbers used destroy security. Anyone knowing the key num-

Figure 3.

```
   MOD((132[D),N);
@: 169


? MOD((523[D),N);
@: 523


? MOD((153[D),N);
@: 856


? MOD((718[D),N);
@: 792


? MOD((252[D),N);
@: 400


? MOD((315[D),N);
@: 944


? MOD((371[D),N);
@: 297


? MOD((530),N);
@: 530


?
```

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Trapdoor Algorithm, continued...

bers N and E could factor N quickly, using the method in Listing 2, and so recover D. A little experimentation would show him that the message had been divided into groups of three digits: only when he calculated groups of three raised to D, mod N, would he recover a range of about 26 two digit numbers.

Listing 2.

```
10 PRINT #0
20 DIM A(250),B(100),PR(45),X(10)
30 L=1
40 FOR I=1 TO 10: REM Read the prime values into array X.
50 READ X(I)
60 NEXT I
70 GOSUB 410
80 FOR I=1 TO 9: REM Get the different combinations of primes
90 FOR J=I+1 TO 10
100 A=X(I):B=X(J)
110 N=A*B:      REM Form the product, called N.
120 PR=(A-1)*(B-1)
130 PRINT #0,USING"######",A;B;N;A-1;B-1;
140 GOSUB 230
150 PR=PR*A+1
160 PR(L)=PR:L=L+1
170 PRINT #0,USING "########",PR;
180 GOSUB 330
190 NEXT J
200 NEXT I
210 END
220 DATA 19,23,29,31,37,41,43,47,53,57
230 REM EUCLID'S GREATEST COMMON DIVISOR
240 A=A-1:B=B-1
250 IF A>B THEN T=A:A=B:B=T
260 C=B-INT(B/A)*A
270 IF C=0 THEN 310: REM: A is the greatest common divisor
280 IF C=1 THEN 320:REM THE NUMBERS ARE RELATIVELY PRIME
290 B=C
300 GOTO 250
310 PRINT #0,USING "####",A;:RETURN
320 PRINT #0,USING "####",1;:RETURN
330 REM FIND THE FACTORS
340 FOR Q=1 TO 55
350 D=B(Q)
360 IF D=0 THEN 390
370 IF PR/D=INT(PR/D) THEN PRINT #0, USING"######",D;PR/D:RETURN
380 NEXT Q
390 PRINT #0
400 RETURN
410 A=1:L=A:M=0:Q=250:N=16
420 FOR M=2 TO 250
430 IF A(M)=1 THEN NEXT M:GOTO 490
440 FOR J=M+M TO Q STEP M
450 IF J>250 THEN NEXT M:GOTO 490
460 A(J)=A
470 NEXT J
480 NEXT M
490 FOR K=2 TO Q: IF A(K)=0 THEN B(L)=K: L=L+1
500 NEXT K
510 L=0:I=L
520 RETURN
```

Listing 3.

```
10 PRINT "This program converts messages into three=digit groups."
20 PRINT "Use only capital letters and spaces, spelling out num-"
30 PRINT "bers and punctuation."
40 INPUT LINE A$
50 DIM A(LEN(A$))
60 L=LEN(A$)
70 FOR I=1 TO L
80 A(I)=ASC(LEFT$(A$,1))-54
90 A$=MID$(A$,2)
100 IF A(I)=-22 THEN A(I)=37
110 NEXT I
120 FOR J=1 TO L STEP 3
130 A=A(J):B=A(J+1):C=A(J+2)
140 B1=INT(B/10)
150 PRINT USING "###", 10*A+B1
160 PRINT USING "###", 100*(B-10*B1)+C
170 NEXT J
```

Worse still, a cryptographer looking at the cipher message would know immediately that some type of polyalphabetic substitution had been used. The methods of solving that type of cipher are well known and do not depend on a knowledge of the key. With a longer message, repetitions and frequency counts would provide valuable clues.

Returning to the trapdoor algorithm, I have one further point to make. The method requires obtaining D and E from P and Q. The security of the method depends on choosing P*Q=N large enough that N cannot possibly be factored in a reasonable time. But D and E were obtained by factoring GCD*(P-1)*(Q-1)+1, a number which will approach N in size. It looks, then, as though we shall find it as hard to select our keys as it would be for someone else to break our cipher. And as Table 1 illustrates, we could choose P and Q unwisely, in which case we would lose the labor we expend in trying to factor a prime number. ☐

Table 1.

P	Q	N	R	S	GCD	PROD	D	E
19	23	437	18	22	2	793	13	61
19	29	551	18	28	2	1009		
19	31	589	18	30	6	3241	7	463
19	37	703	18	36	18	11665	5	2333
19	41	779	18	40	2	1441	11	131
19	43	817	18	42	6	4537	13	349
19	47	893	18	46	2	1657		
19	53	1007	18	52	2	1873		
19	57	1083	18	56	2	2017		
23	29	667	22	28	2	1233	3	411
23	31	713	22	30	2	1321		
23	37	851	22	36	2	1585	5	317
23	41	943	22	40	2	1761	3	587
23	43	989	22	42	2	1849	43	43
23	47	1081	22	46	2	2025	3	675
23	53	1219	22	52	2	2289	3	763
23	57	1311	22	56	2	2465	5	493
29	31	899	28	30	2	1681	41	41
29	37	1073	28	36	4	4033	37	109
29	41	1189	28	40	4	4481		
29	43	1247	28	42	14	16465	5	3293
29	47	1363	28	46	2	2577	3	859
29	53	1537	28	52	4	5825	5	1165
29	57	1653	28	56	28	43905	3	14635
31	37	1147	30	36	6	6481		
31	41	1271	30	40	10	12001	11	1091
31	43	1333	30	42	6	7561		
31	47	1457	30	46	2	2761	11	251
31	53	1643	30	52	2	3121		
31	57	1767	30	56	2	3361		
37	41	1517	36	40	4	5761	7	823
37	43	1591	36	42	6	9073	43	211
37	47	1739	36	46	2	3313		
37	53	1961	36	52	4	7489		
37	57	2109	36	56	4	8065	5	1613
41	43	1763	40	42	2	3361		
41	47	1927	40	46	2	3681	3	1227
41	53	2173	40	52	4	8321	53	157
41	57	2337	40	56	8	17921		
43	47	2021	42	46	2	3865	5	773
43	53	2279	42	52	2	4369	17	257
43	57	2451	42	56	14	32929	13	2533
47	53	2491	46	52	2	4785	3	1595
47	57	2679	46	56	2	5153		
53	57	3021	52	56	4	11649	3	3883

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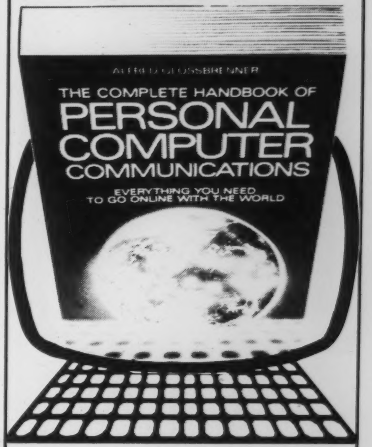
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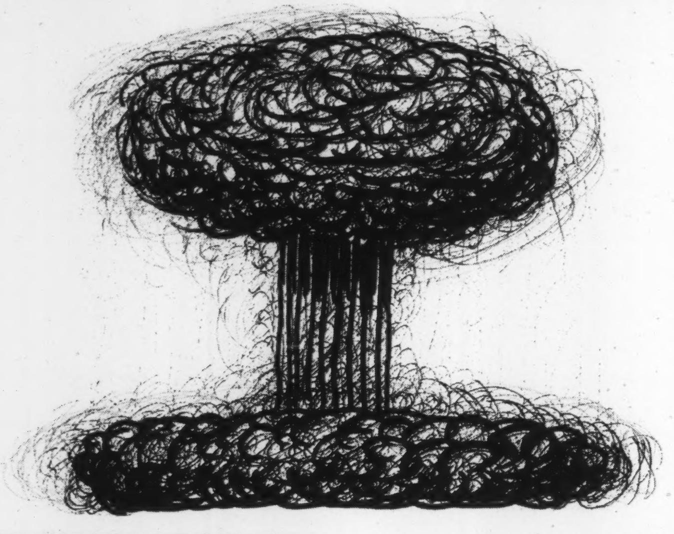
Will WWIII Be An Accident?

The Apocalypse Equations



Howard S. Balsam

The last book of the Bible is that of Revelation or Apocalypse. It describes the end of this world with the Battle of Armageddon and the advent of the next and perfect world. Engendered by the growth of nuclear weaponry over the last 35 years and by massive and skillful Kremlin-fanned propaganda, there is a widespread fear of starting Armageddon by accidentally launching an armed nuclear missile from either the United States or Soviet Russia.

In the *Harvard Magazine* for March/April, 1982 appeared a letter by one Bradford Lyttle, of Chicago, presenting three forms of an equation which he says gives the probability of such an accidental Armageddon. The Apocalypse program, which follows, presents these equations so you may investigate the presumed probability of Apocalypse.

Probability is often expressed as a decimal between zero and one. A probability near zero indicates that the chances of a given event ocurring are considered very low. A probability near one says that the chances are very high that the event will occur. Probabilities exceeding about 0.95 are often considered practically certain. Probability is expressed as a percentage in this program: 100% = 1.00, a certainty.

The Equations

The three equations use these symbols:

AP is the Probability of Apocalypse, that is, the probability over a period of time that the accidental launch of one nuclear missile by either the United States or the Soviet Union would falsely trigger a nuclear World War III.

U is the total number of strategic missiles in the U.S. arsenal. The program suggests 1900. You may wish to adjust this.

S is the total number of strategic missiles in the Soviet arsenal. The program suggests 2200; again, you may adjust this value.

P is the probability of the accidental launching of an armed strategic nuclear missile by either the U.S. or the Soviet Union during any 24-hour period. The program suggests that there is one chance in one hundred million of this: 1E-8. Change this if desired.

Run the program and find out what the future holds—if anything.

N is the number of days in the period considered. You may enter whatever period you wish: the program suggests 14,600 days—40 years. You may consider that the clock started ticking perhaps 20 years ago, with a much smaller number of missiles.

The three equations given by Mr. Lyttle are:

Approximate:

$$AP = 1-(1-P(U+S))^{N}$$

Closer approximation:

$$AP = 1-e^{(-NP(U+S))}$$

Exact Form:

$$AP = 1-(1-P)^{(N(U+S))}$$

It turns out that the values given by the first two equations are usually very close to one another, while the exact equation gives a slightly smaller value.

Program Structure

The Applesoft program consists of 14 sections or routines ranging from 1 to 12 lines each in length. In approximate order of operation, the main routines are:

1000-1090 Introduction
800- 890 Menu
600- 720 Entries
300- 370 Approximate Equation
400- 470 Closer Approximation
500- 570 Exact Equation
140- 180 Results

Brief routines handle such operations as centering phrases on the screen, rounding numbers, rejecting out-of-line values, and beeping three times. The Entries subroutine is designed to minimize number re-entries; after the initial entries, each re-entry with the same value can be made with one keystroke. The program is fairly well bullet-proofed and includes many REMarks.

Variations

While the program considers strategic missiles of the U.S. and Soviet Russia only, the nuclear "club" is growing. You may modify the program accordingly.

You may wish to take a short-cut, at least for a minimum-effort trial. If so, try skipping lines 1000-1090 (Introduction).

If you do this, make line 10 read: GOTO 810. Of course, you may also omit the REMs. If you find the beeps annoying, delete lines 70-80 and GOSUB 80 in lines 200, 350, 450, 550, 890 and 1100.

Now, RUN the program and find out what the future holds—if anything. ☐

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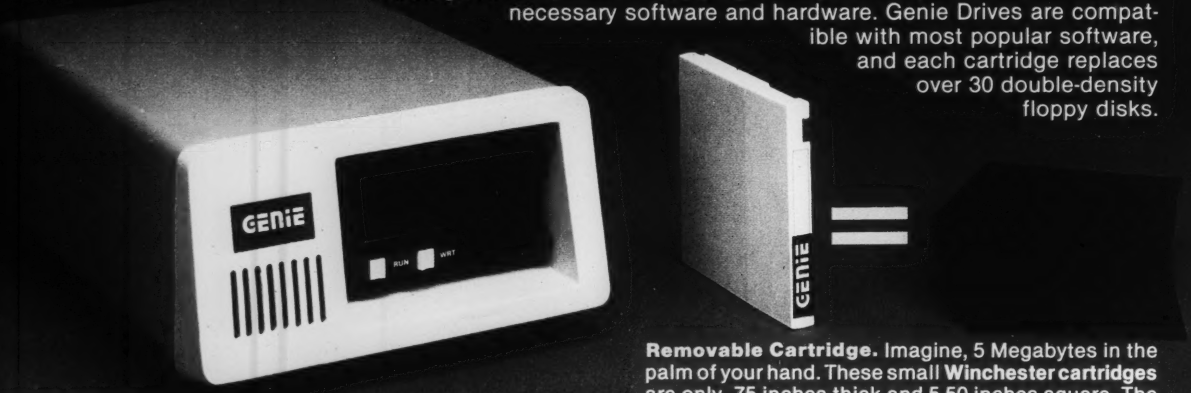

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```
10  GOTO 1010: REM  GO FOR INTRO.
20  REM  BY HOWARD S. BALSAM.
30  REM  < ROUNDING ROUTINE >
40 X1 = 100 * X:X =  INT (X1 * 100 + .5) / 100: RETURN
50  REM  < CENTERING ROUTINE >
60  HTAB ((40 -  LEN (T$)) / 2 + 1): PRINT T$: RETURN
70  REM  < BEEP ROUTINE >
80  CALL  - 198: CALL  - 198: CALL  - 198: RETURN
90  REM  <CONTINUATION ROUTINE>
100  PRINT "HIT ANY KEY TO CONTINUE ";: GET Z$: PRINT : RETURN
140  REM  < RESULTS ROUTINE >
150  IF A1 THEN  PRINT "APPROXIMATE PROBABILITY IS      "A1"%": PRINT
160  IF A2 THEN  PRINT "CLOSER APPROXIMATION IS         "A2"%": PRINT
170  IF A3 THEN  PRINT "EXACT PROBABILITY IS            "A3"%": PRINT
180  RETURN
190  REM  < REJECTION ROUTINE >
200  INVERSE : PRINT "PLEASE ENTER A MORE REALISTIC VALUE.": GOSUB 80: FOR
     T = 1 TO 1500: NEXT T: NORMAL : VTAB VT + 1: CALL  - 958: RETURN : REM
      DISPLAY REJECTION FOR READING, BEEPS, MOVE UP AND CLEAR SCREEN BELOW
     .
299  REM  < THREE FORMS OF EQ. >
300  HOME :T$ = "<A> APPROXIMATE FORM": GOSUB 60: PRINT
310  HTAB 12: PRINT "AP = 1-" CHR$ (91)"1-P(U+S)]^N": PRINT
320  GOSUB 620: REM  GO FOR ENTRIES.
330 A1 = 1 - (1 - P * (U + S)) ^ N
340 X = A1: GOSUB 40:A1 = X: REM PER CENT AND ROUNDING.
350  PRINT : GOSUB 150: GOSUB 80: PRINT : REM  DISPLAY RESULTS, WITH 3 BEE
     PS.
360  PRINT : PRINT : GOSUB 100
370  GOTO 810: REM  BACK TO MENU.
400  HOME :T$ = "<C> CLOSER APPROXIMATION": GOSUB 60: PRINT
410 T$ = "AP = 1-EXP(-NP(U+S))": GOSUB 60: PRINT
420  GOSUB 620: REM GO FOR ENTRIES.
430 A2 = 1 -  EXP ( - N * P * (U + S))
440 X = A2: GOSUB 40:A2 = X: REM PER CENT AND ROUNDING.
450  PRINT : GOSUB 150: GOSUB 80: PRINT : REM  DISPLAY RESULTS, WITH 3 BEE
     PS.
460  PRINT : PRINT : GOSUB 100
470  GOTO 810: REM   BACK TO MENU.
500  HOME :T$ = "<E> EXACT EQUATION": GOSUB 60: PRINT
510 T$ = "AP = 1-(1-P) ^ N(U+S)": GOSUB 60: PRINT
520  GOSUB 620: REM GO FOR ENTRIES.
530 A3 = 1 - (1 - P) ^ (N * (U + S))
540 X = A3: GOSUB 40:A3 = X: REM PER CENT AND ROUNDING.
550  PRINT : GOSUB 150: GOSUB 80: PRINT : REM  DISPLAY RESULTS, WITH 3 BEE
     PS.
560  PRINT : PRINT : GOSUB 100
570  GOTO 810: REM BACK TO MENU.
600  REM    < ENTRIES ROUTINE >
610  REM U%, S%, P%, AND N% ARE FLAGS INDICATING NEW (0) OR CHANGED (0) EN
     TRIES OF THE RESPECTIVE QUANTITIES.  1 = NO CHANGE.
620 U% = 0: IF U THEN  PRINT "IS U= "U" US MISSILES OK?     ";: HTAB 32: PRINT
     "Y/N ";: GET A$: PRINT A$: IF A$ = "Y" THEN U% = 1: GOTO 640
630 VT =  PEEK (37): PRINT "ENTER NO. OF US MISSILES;": INPUT "(POSSIBLE:
     1900):                  ";U: PRINT : IF U < 1000 OR U > 5000 THEN  GOSUB
     200: GOTO 630: REM  VT = VERT. POSITION.
640 S% = 0: IF S THEN  PRINT "IS S= "S" SOVIET MISSILES OK?";: HTAB 32: PRINT
     "Y/N ";: GET A$: PRINT A$: IF A$ = "Y" THEN S% = 1: GOTO 660
650 VT =  PEEK (37): PRINT "ENTER NO. OF SOVIET MISSILES;": INPUT "(POSSIB
     LE: 2200):                  ";S: PRINT : IF S < 1000 OR S > 5000 THEN  GOSUB
     200: GOTO 650
```

```
660 P% = 0: IF P THEN  PRINT "IS P= "P" ACCIDENTAL LAUNCH": HTAB 12: PRINT
     " PROBABILITY OK?";: HTAB 32: PRINT "Y/N ";: GET A$: PRINT A$: IF A$ =
     "Y" THEN P% = 1: GOTO 680
670 VT =  PEEK (37): PRINT "ENTER CHANCE OF ACCIDENTAL LAUNCH OF ": PRINT
     "ANY GIVEN MISSILE OVER ANY 24-HR PERIOD": INPUT "(POSSIBLE: 1E-8):
                    ";P: IF P < 1E - 12 OR P > 1E - 3 THEN  GOSUB 200: GOTO 6
     70
680 N% = 0: IF N THEN  PRINT "IS N= "N" DAYS OK?";: HTAB 32: PRINT "Y/N ";
     : GET A$: PRINT A$: IF A$ = "Y" THEN N% = 1: GOTO 700
690 VT =  PEEK (37): PRINT : PRINT "ENTER NUMBER OF DAYS:": INPUT "(POSSIB
     LE: 14600):                  ";N: PRINT : IF N < 1 OR N > 400000 THEN  GOSUB
     200: GOTO 690
700 FL% = U% + S% + P% + N%: REM  FLAG INDICATING WHETHER ALL OR SOME CHAN
     GES MADE.
710  IF FL% <  > 4 THEN A1 = 0:A2 = 0:A3 = 0: REM IF ANY CHANGES, SUPPRESS
      PREVIOUS RESULTS IN LINES 150-170, READY FOR NEW RESULTS.
720  RETURN
800  REM     < MENU ROUTINE >
810  HOME :T$ = "THE APOCALYPSE EQUATION": GOSUB 60: PRINT :T$ = "HERE ARE
      3 FORMS OF THE EQUATION,": GOSUB 60:T$ = "READY FOR USE.": GOSUB 60:
      PRINT
820  HTAB 10: PRINT "<A> ALGEBRAIC FORM": HTAB 10: PRINT "<C> CLOSER APPRO
     XIMATION":
830  HTAB 10: PRINT "<E> EXACT FORM": HTAB 10: PRINT "<Q> QUIT": PRINT : PRINT

840 VT =  PEEK (37) + 1: PRINT "WHICH IS YOUR CHOICE? ";: GET Z$: REM  VT
     = CURRENT VERT SCREEN POSITION.
850  IF Z$ = "Q" THEN 1100
860  IF Z$ = "A" THEN 300
870  IF Z$ = "C" THEN 400
880  IF Z$ = "E" THEN 500
890  VTAB VT: HTAB 1: CALL  - 868: GOTO 840: REM IF NOT VALID CHOICE, MOVE
      BACK UP, CLEAR LINE, RE-QUESTION.
1000  REM   <INTRODUCTION>
1010  TEXT : HOME :T$ = " <<< APOCALYPSE! >>> ": INVERSE : GOSUB 60: NORMAL
     : PRINT : POKE 34,2:T$ = "THE 'APOCALYPSE EQUATION': FROM A": GOSUB 6
     0::T$ = "LETTER FROM BRADFORD LYTTLE, CHICAGO,": GOSUB 60
1020 T$ = "IN 'HARVARD MAGAZINE,' MAR-APR 1982,": GOSUB 60
1030 T$ = "PAGE 19.  THE AUTHOR PRESENTS THREE": GOSUB 60:T$ = "EQUATIONS
     WHICH HE SAYS GIVE THE": GOSUB 60:T$ = "PROBABILITY OF AN ACCIDENTAL
     EXPLOSION": GOSUB 60:T$ = "OF A NUCLEAR WEAPON OVER TIME.": GOSUB 60
1040 T$ = "HE SPECIFICALLY DEALS WITH THE": GOSUB 60:T$ = "CHANCE OF THE A
     CCIDENTAL LAUNCH OF A": GOSUB 60:T$ = "STRATEGIC MISSILE, CONSIDERING
      ONLY THE": GOSUB 60:T$ = "U.S. AND THE USSR.": GOSUB 60
1050  PRINT :T$ = "IT IS PRESUMED THAT SUCH AN ACCIDENT": GOSUB 60:T$ = "W
     OULD TRIGGER THE APOCALYPSE.": GOSUB 60
1060  PRINT :T$ = "YOU MAY PLAY WITH THESE EQUATIONS,": GOSUB 60:T$ = "COM
     PARING THEIR RESULTS WITH EACH OTHER": GOSUB 60:T$ = "AND WITH GOD'S
     REAL WORLD.": GOSUB 60: PRINT : GOSUB 100
1070  HOME :T$ = "SYMBOLS USED:": GOSUB 60: PRINT : PRINT : PRINT "AP = PR
     OBABILITY OF APOCALYPSE": PRINT "(I.E., PROBABILITY THAT ACCIDENTAL "
     ,"LAUNCH OF 1 MISSILE WOULD FALSELY ","TRIGGER A FULL-FLEDGED NUCLEAR
      WAR.)"
1080  PRINT : PRINT "U = NO. U.S. MISSILES": PRINT : PRINT "S = NO. SOVIET
      MISSILES": PRINT
1090  PRINT "P = PROBABILITY OF ACCIDENTAL LAUNCH","    OF ANY MISSILE IN
     A 24-HOUR PERIOD": PRINT : PRINT "N = NO. OF DAYS IN TOTAL PERIOD","
        CONSIDERED": PRINT : PRINT : GOSUB 100: GOTO 810
1100  VTAB 20:T$ = "END OF 'APOCALYPSE!'": GOSUB 60: GOSUB 80: TEXT : VTAB
     20: END
```

A Program to Calculate the Limits to Growth

Where Are We Headed?

Mark Lewis Baldwin

The world population has been growing exponentially for as long as history has been recorded. Without constraint, it would continue to do so, but there are constraints on our world system. There are limited amounts of land, food, and other natural resources. Even now, as we approach these limits, the world population shows signs of breaking its growth trends.

Jay W. Forrester presented this concept to the world over ten years ago in his book *World Dynamics*. He described a world dynamics computer model which predicted the breakdown of the growth patterns and showed how a breakdown in certain cases could be catastrophic. The implications of this model were further explored in the better known work *Limits to Growth*.

The world dynamics model was originally written in Dynamo by Dr. Forrester at MIT. The entire computer model has now been written in Atari Basic, so that anyone may experiment with the capabilities of the model.

Dr. Forrester's model treats the world as a closed continuous system, and models each important parameter in the system. Variables which measure levels, sometimes known as state variables, in this model include population (P), natural resources (NR), capital investment (CI), pollution (POL) and the fraction of capital devoted to agriculture (CIAF).

Each of these state variables affects the change of the other state variables through a set of relationships. It is the definition of these relationships which reflects both the accuracy of the model and its actions. Small changes in a relationship between two states could cause vast changes in the action of the model.

Let us examine a small portion of the

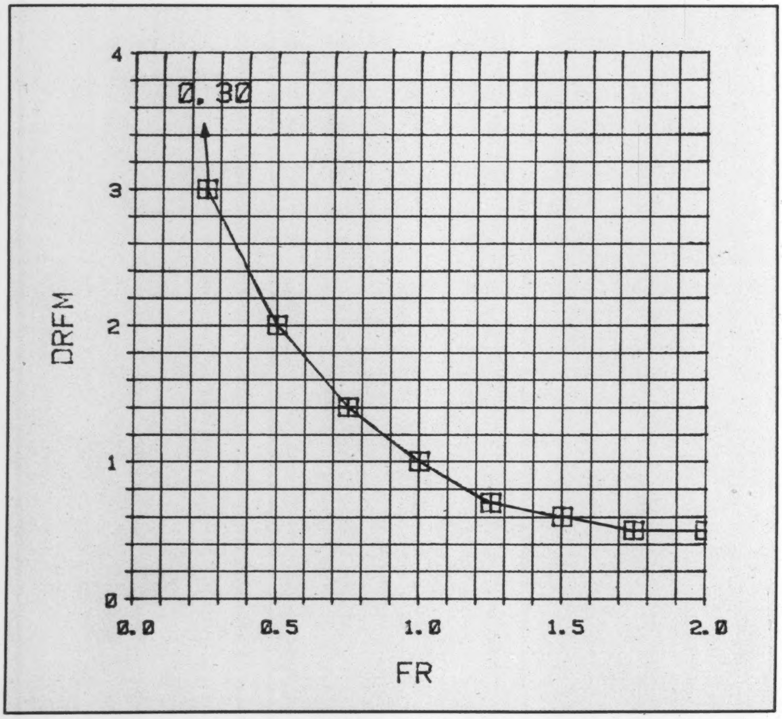

Figure 1. Death-rate-from-food multiplier vs. food ratio.

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CIRCLE 154 ON READER SERVICE CARD

model. The population of the earth is affected directly by two factors, the death rate and the birth rate. If we were modeling a smaller system such as a country, we would also have to include immigration and emigration.

The birth rate in the world is approximately 4 percent per year. In the model, this value is BRN for Birth Rate Normal. Likewise, the death rate (DRN) is at 2 percent. These rates are approximations based on the year 1970 and include the entire world, not just the United States.

If these rates stayed the same, we would be able by simple integration to predict the world population at any future time, but these rates vary for many reasons. If the available food (Food Ratio, FR) decreases, the death rate varies in some inverse proportion until no food at which point the death rate becomes 100 percent. On the other hand, if an infinite food supply is available, the death rate does not drop to zero but asymptotically approaches some value that is less than what currently exists today.

Figure 1 shows the relationship between food and death rate incorporated into the model. This table appears on line 8290 in the program. Other factors which influence the death rate include crowding (CR), pollution (POLR), and the material standard of living (MSL). All of the other rates in the model are controlled by the same types of considerations.

The model then integrates the values over time and we have our world simulation. The Basic version uses only a first order integration scheme with a step size of one year. Better integration schemes could be used but it seemed impractical considering the original approximations in the model.

What happens when we incorporate all of these factors? Figure 2 is a plot produced on an Atari showing some of the important variables and how they change with time. Variable values plotted include population, pollution, capital investment, food, natural resources, and the quality of life.

If the model is accurate, it shows that if the world continues on its current path, the population will peak in the year 2020. At the same time, the quality of life (Q)

Color	Symbol	Description
■ Red	N	Natural resources
■ Blue	F	Food ratio
■ Green	Q	Quality of life
■ Purple	P	Population
■ Brown	C	Capital Investment
■ Orange	2	Pollution Ratio

Figure 2. The world on its current path.

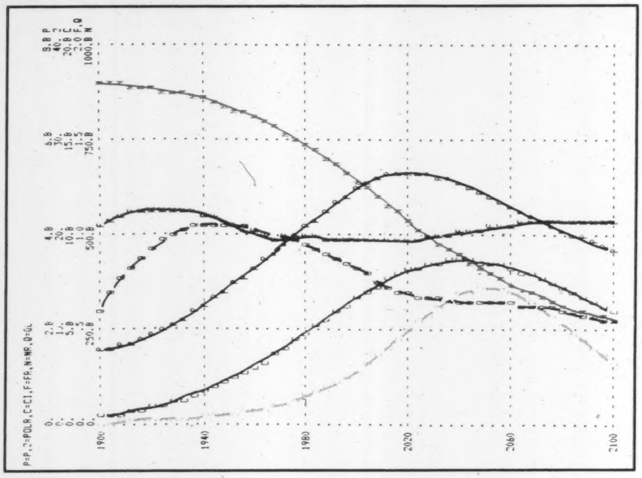


Figure 3. The world with a 25% reduction in birth rate.

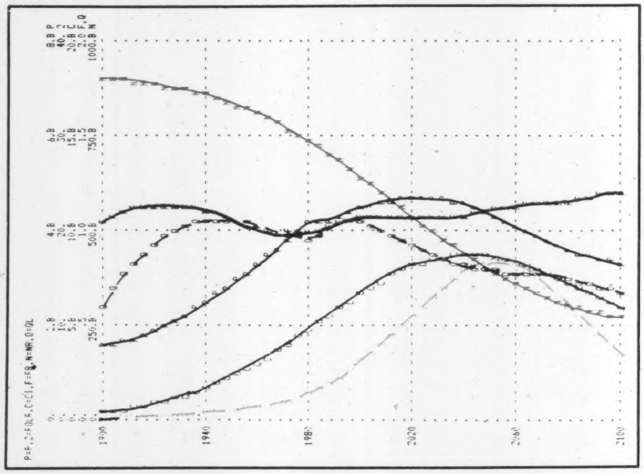
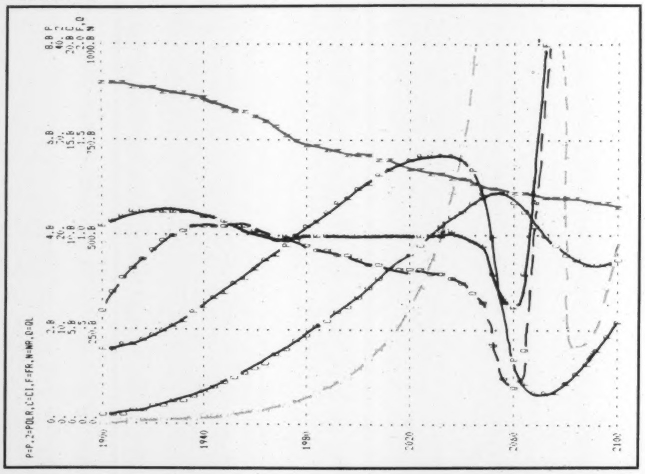


Figure 4. The world with a 75% reduction in the usage of natural resources.



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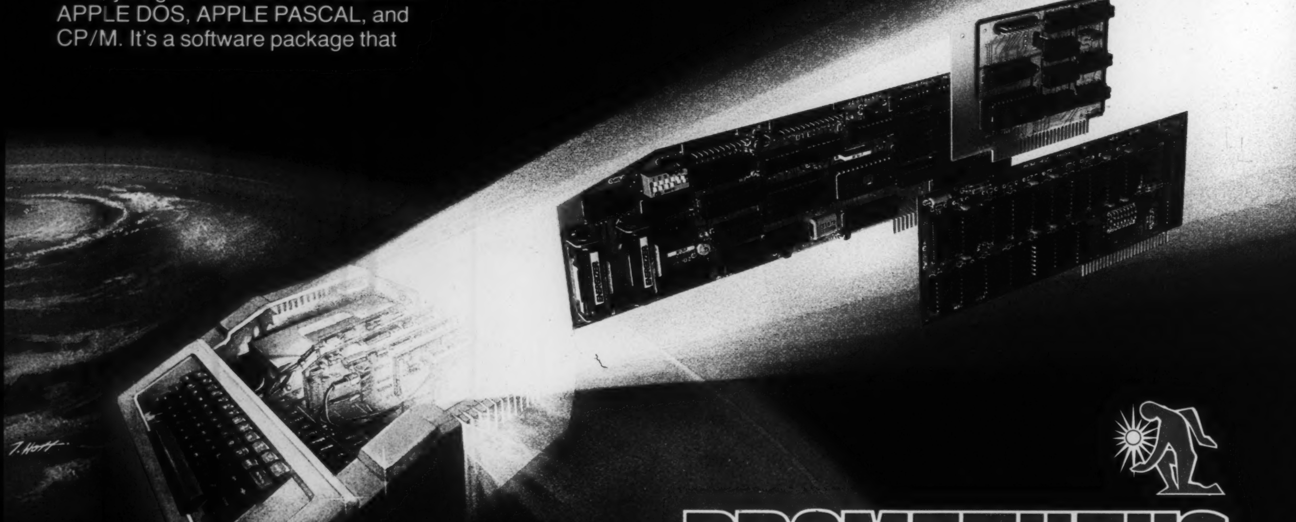

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will decrease significantly. One of the important detrimental factors will be a large scale increase in pollution and a drop in natural resources (NR).

Can we do something about this? One of the most common suggestions is to control the birth rate. This is simple to test by inserting the following statement:

```
1495 IF TIME>1980 THEN BRN=.03
```

What we have done is decrease the birth rate by 25 percent to 3 percent starting in 1980. Figure 3 shows the results of this experiment. The change in birth rate helped some temporarily, but in the long run seemed to have little effect.

What else can we try? Well, the government is always asking us to conserve our resources. Let's try cutting the consump-

Table 1. Micro-World Dynamics Variables

BR	Birth Rate (people/year)
BRCM	Birth Rate from Crowding Multiplier (dimensionless)
BRFM	Birth Rate from Food Multiplier (dimensionless)
BRMM	Birth Rate from Material Multiplier (dimensionless)
BRN	Birth Rate Normal (fraction/year)
BRPM	Birth Rate from Pollution Multiplier (dimensionless)
CFIFR	Capital Fraction Indicated by Food Ratio (dimensionless)
CI	Capital Investment (capital units)
CIAF	Capital Investment in Agriculture Fraction (dimensionless)
CIAFN	Capital Investment in Agriculture Fraction Normal (dimensionless)
CIAFT	Capital Investment in Agriculture Fraction adjustment Time (years)
CID	Capital Investment Discard (capital units/year)
CIDN	Capital Investment Discard Normal (fraction/year)
CIG	Capital Investment Generation (capital units/year)
CIGN	Capital Investment Generation Normal (capital units/person/year)
CIM	Capital Investment Multiplier (dimensionless)
CIQR	Capital Investment from Quality Ratio (dimensionless)
CIR	Capital Investment Ratio (capital units/person)
CIRA	Capital Investment Ratio in Agriculture (capital units/person)
CR	Crowding Ratio (dimensionless)
DR	Death Rate (people/year)
DRCM	Death Rate from Crowding Multiplier (dimensionless)
DRFM	Death Rate from Food Multiplier (dimensionless)
DRMM	Death Rate from Material Multiplier (dimensionless)
DRN	Death Rate Normal (fraction/year)
DRPM	Death Rate from Pollution Multiplier (dimensionless)
ECIR	Effective Capital Investment Ratio (capital units/person)
ECIRN	Effective Capital Investment Ratio Normal (capital units/person)
FC	Food Coefficient (dimensionless)
FCM	Food from Crowding Multiplier (dimensionless)
FN	Food Normal (food units/person/year)
FPCI	Food Potential from Capital Investment (food units/person/year)
FPM	Food from Pollution Multiplier (dimensionless)
FR	Food Ratio (dimensionless)
LA	Land Area (square kilometers)
MSL	Material Standard of Living (dimensionless)
NR	Natural Resources (natural resource units)
NREM	Natural Resource Extraction Multiplier (dimensionless)
NRFR	Natural Resource Fraction Remaining (dimensionless)
NRI	Natural Resource, Initial (natural resource initial)
NRMM	Natural Resource from Material Multiplier (dimensionless)
NRUN	Natural Resource Usage Normal (natural resource units/person/year)
NRUR	Natural Resource Usage Rate (natural resource units/person/year)
P	Population (people)
PDN	Population Density Normal (people/square kilometer)
POL	Pollution (pollution units)
POLA	Pollution Absorption (pollution units/year)
POLAT	Pollution Absorption Time (years)
POLCM	Pollution from Capital Multiplier (dimensionless)
POLG	Pollution Generation (pollution units/year)
POLN	Pollution Normal (pollution units/person/year)
POLR	Pollution Ratio (dimensionless)
POLS	Pollution Standard (pollution units)
QL	Quality of Life (satisfaction units)
QLC	Quality of Life from Crowding (dimensionless)
QLF	Quality of Life from Food (dimensionless)
QLM	Quality of Life from Material (dimensionless)
QLP	Quality of Life from Pollution (dimensionless)
QLS	Quality of Life Standard (satisfaction units)
TIME	Calendar Time (years)

Other Program Variables

B$	String containing blanks
DT	Integration step size (years)
DVAL	Output value from table lookup routine
GRAPH	Address of screen graph subroutine
I,J	Temporary loop counters
INTVL	X interval in table lookup routine
IVAL	Input value for table lookup routine
MARK	Address of subroutine to mark screen plot
P$	String containing print line for printer routine
PRNT	Address of subroutine to print plot
TAB	Table to be looked up
TABLE	Array containing tables to lookup relationships or variables
TABLK	Address of table lookup routine
X	Horizontal position for plot routines
XLOI	X low for table lookup routine
Y	Vertical position for plot routines

tion of natural resources by 75 percent. This is easily done by adding the following line:

```
1495 IF TIME>1980 THEN NRUN=.25
```

Look at Figure 4 for the results. A policy of reducing natural resource usage alone could be catastrophic to the world, by the year 2060, cutting our population by 80 percent. Here is an example of an obvious solution doing the opposite of what anyone would expect. Thought and analysis need to go into the decisions made by our world leaders.

That is where this model and more detailed variations of it are important. It allows us to examine and experiment with systems which are complex in nature without destroying what we are testing. That is the real value of any computer model.

The Basic program is shown in Listing 1. Table 1 lists all of the variables. For simplicity, the variable names are the same as those used in the original model.

Four of the subroutines in the program are specific to the Atari as they enable the computer to plot the results. Subroutine 10000 initializes the plotting routine for the screen while 12000 does the same for an Epson MX-80 printer. Routines 11000 and 13000 plot the data on the screen and printer respectively.

The rest of the program should be easily translatable into other Basics, so you need only write your own output routines.

A large number of simplifications and assumptions were required in the original model. Although there has been a great deal of argument in academic circles about the accuracy of Forrester's model, it is a first attempt at solving and describing a complex system, and it does provide some insights into the problem.

Don't just run the program, experiment with it. Vary the parameters and see what you can do with the world in your computer.

References

Forrester, Jay W., *World Dynamics* (Cambridge: Wright-Allen Press, 1971).

Meadows, Donella H.; Meadows, Dennis L.; Randers, Jorgen; and Behrens, William W. III, *The Limits To Growth, A Report For The Club Of Romes Project On The Predicament Of Mankind* (New York: Universe Books, 1972). □

```
10     REM ****************************
11     REM *   MICRO-WORLD DYNAMICS    *
12     REM *                          *
13     REM * BASED ON  WORLD DYNAMICS *
14     REM *  BY J W FORRESTER (1972) *
15     REM * AND LIMITS TO GROWTH     *
16     REM * BY D L MEADOWS (1972)    *
17     REM *                          *
18     REM *  WRITTEN BY MARK BALDWIN *
19     REM * BEACON TECHNICAL SERVICES*
20     REM ****************************
30     PRINT "}        MICRO-WORLD DYNAMICS"
31     PRINT "  BASED ON WORLD DYNAMICS BY "
       :PRINT "  J W FORRESTER (1972)"
32     PRINT "  AND LIMITS TO GROWTH BY"
       :PRINT "  D L MEADOWS (1972)"
33     PRINT
       :PRINT "  BY MARK LEWIS BALDWIN"
34     PRINT "    PLEASE WAIT . . ."
50     DIM TABLE(21,12)
90     TABLK=9000
       :GRAPH=11000
       :MARK=11900
       :PRNT=13000
100    REM INITIALIZE WORLD
101    P=1650000000
       :REM POPULATION (PEOPLE)
102    BRN=0.04
       :REM BIRTH RATE NORMAL (FRACTION/YEAR)
103    TIME=1900
       :REM SIMULATION START TIME
104    NR=9E+11
       :NRI=NR
       :REM NATURAL RESOURCES (NATURAL RESOURSE UNITS)
105    ECIRN=1
       :REM EFFECTIVE CAPITAL INVESTMENT RATIO NORMAL (CAPITAL UNITS/PERSON)
106    DRN=0.028
       :REM DEATH RATE NORMALFRACTION/YEAR)
107    PDN=26.5
       :REM POPULATION DENSITY NORMAL (PEOPLE/SQUARE KILOMETER)
108    FC=1
       :REM FOOD COEFICIENT (DIMENSIONLESS)
109    CIAFN=0.3
       :REM CAPITAL INVESTMENT IN AGRICULTURE FRACTION NORMAL (DIMENSIONLESS)
110    CI=400000000
       :REM CAPITAL INVESTMENT (CAPITAL UNITS)
111    CIGN=0.05
       :REM CAPITAL INVESTMENT GENERATION NORMAL (CAPITAL UNITS/PERSON/YEAR)
112    CIDN=0.025
       :REM CAPITAL INVESTMENT DISCARD NORMAL (FRACTION/YEAR)
```

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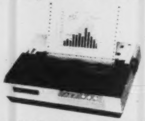

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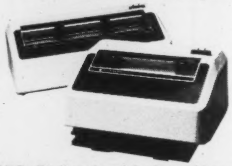

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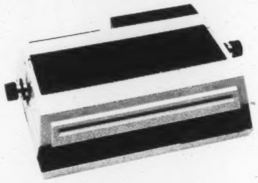

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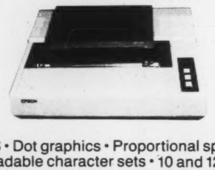

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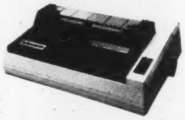

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Limits to Growth, continued...

```
 113   POLS=3600000000
       :REM POLLUTION STANDARD (POLUTION UNITS)
 114   POL=200000000
       :REM POLUTION (POLUTION UNITS)
 115   POLN=1
       :REM POLUTION NORMAL (POLLUTION UNITS/PERSON/YEAR)
 116   CIAF=0.2
       :REM CAPITAL INVESTMENT IN AGRICULTURE FRACTION (DIMENSIONLESS)
 117   CIAFT=15
       :REM CAPITAL INVESTMENT IN AGRICULTURE FRACTION ADJUSTMENT TIME (YEARS)
 118   QLS=1
       :REM QUALITY OF LIFE STANDARD (SATISFACTION UNITS)
 119   DT=1
       :REM TIME STEP SIZE (YEARS)
 120   LA=135000000
       :REM LAND AREA (SQUARE KILOMETERS)
 121   FN=1
       :REM FOOD NORMAL (FOOD UNITS/PERSON/YEAR)
 123   NRUN=1
 130   GOSUB 8000
       :REM INITIALIZE TABLES
 140   GOSUB 10000
       :REM INITIALIZE SCREEN PLOT
 150   GOSUB 12000
       :REM INITIALIZE PRINTER PLOT
1000   REM WORLD LOOP
1001   NRFR=NR/NRI
1010   CR=P/(LA*PDN)
1020   CIR=CI/P
1030   TAB=0
       :IVAL=NRFR
       :GOSUB TABLK
       :NREM=DVAL
1040   ECIR=CIR*(1-CIAF)*NREM/(1-CIAFN)
1050   MSL=ECIR/ECIRN
1060   TAB=1
       :IVAL=MSL
       :GOSUB TABLK
       :BRMM=DVAL
1070   TAB=2
       :IVAL=MSL
       :GOSUB TABLK
       :DRMM=DVAL
1080   TAB=3
       :IVAL=CR
       :GOSUB TABLK
       :DRCM=DVAL
1090   TAB=4
       :IVAL=CR
       :GOSUB TABLK
       :BRCM=DVAL
1100   CIRA=CIR*CIAF/CIAFN
1110   TAB=5
       :IVAL=CIRA
       :GOSUB TABLK
       :FPCI=DVAL
1120   TAB=6
       :IVAL=CR
       :GOSUB TABLK
       :FCM=DVAL
1130   POLR=POL/POLS
1140   TAB=7
       :IVAL=POLR
       :GOSUB TABLK
       :FPM=DVAL
1150   FR=FPCI*FCM*FPM*FC/FN
1160   TAB=8
       :IVAL=MSL
       :GOSUB TABLK
       :CIM=DVAL
1170   TAB=9
       :IVAL=CIR
       :GOSUB TABLK
       :POLCM=DVAL
```

```
 1180  TAB=10
        :IVAL=POLR
        :GOSUB TABLK
        :POLAT=DVAL
 1190  TAB=11
        :IVAL=FR
        :GOSUB TABLK
        :CFIFR=DVAL
 1200  TAB=12
        :IVAL=MSL
        :GOSUB TABLK
        :QLM=DVAL
 1210  TAB=13
        :IVAL=CR
        :GOSUB TABLK
        :QLC=DVAL
 1220  TAB=14
        :IVAL=FR
        :GOSUB TABLK
        :QLF=DVAL
 1230  TAB=15
        :IVAL=POLR
        :GOSUB TABLK
        :QLP=DVAL
 1240  TAB=16
        :IVAL=MSL
        :GOSUB TABLK
        :NRMM=DVAL
 1250  TAB=17
        :IVAL=QLM/QLF
        :GOSUB TABLK
        :CIQR=DVAL
 1260  TAB=18
        :IVAL=POLR
        :GOSUB TABLK
        :DRPM=DVAL
 1270  TAB=19
        :IVAL=FR
        :GOSUB TABLK
        :DRFM=DVAL
 1280  TAB=20
        :IVAL=FR
        :GOSUB TABLK
        :BRFM=DVAL
 1290  TAB=21
        :IVAL=POLR
        :GOSUB TABLK
        :BRPM=DVAL
1300   REM RATE COMPONENTS
1310   BR=P*BRN*BRFM*BRMM*BRCM*BRPM
1320   DR=P*DRN*DRMM*DRPM*DRFM*DRCM
1330   NRUR=P*NRUN*NRMM
1340   CIG=P*CIM*CIGN
1350   CID=CI*CIDN
1360   POLG=P*POLN*POLCM
1370   POLA=POL/POLAT
1400   REM LEVELS
1410   QL=QLS*QLM*QLC*QLF*QLP
1420   P=P+DT*(BR-DR)
1430   NR=NR-DT*NRUR
1450   CI=CI+DT*(CIG-CID)
1460   POL=POL+DT*(POLG-POLA)
1470   CIAF=CIAF+DT*(CFIFR*CIQR-CIAF)/CIAFT
1480   GOSUB GRAPH
       :GOSUB PRNT
       :REM GRAPHS DATA
1490   TIME=TIME+DT
1500   IF TIME<2102 THEN
          1000
1510   GO TO 1510
8000   FOR I=0 TO 21
        :FOR J=0 TO 12
8020     READ DATA
         :TABLE(I,J)=DATA
        :NEXT J
      :NEXT I
```

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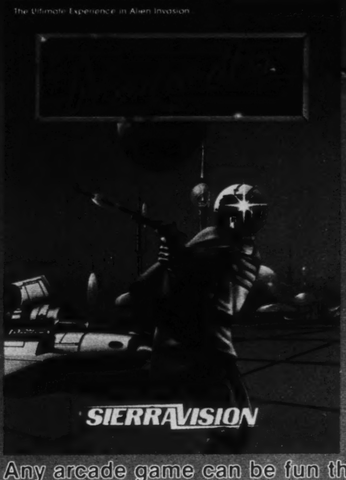

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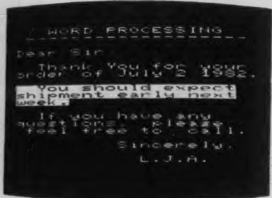
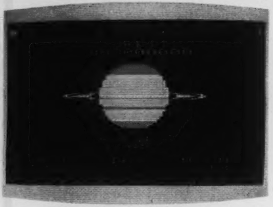


```
WORD PROCESSING
Dear Sir
  Thank You for your
order of July 2 1982.
  You should expect
shipment early next
week.
  If you have any
questions, please
feel free to call.
          Sincerely,
             L.J.A.
```

BUSINESS



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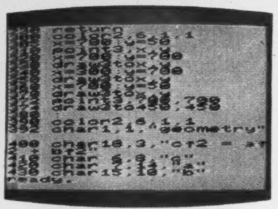
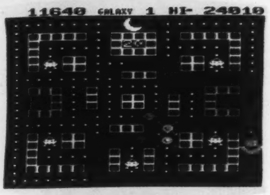


```
return
color2,6,1,1
x=700 y=50
point3,x,y
x=700 y=700
drawtox,y
x=300 y=700
drawtox,y
x=700 y=50
drawtox,y
point3,700,700
drawto450,450
color2,6,1,1
char1,1,"geometry"
400 char18,3,"c↑2 = a↑
2 + b↑2"
410 char 5,8,"a"
420 char 7,11,"c"
430 char15,10,"b"
ready.
```

PROGRAMMING



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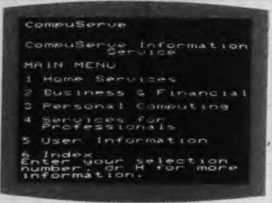

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6 Index
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number, or H for more
information.
```

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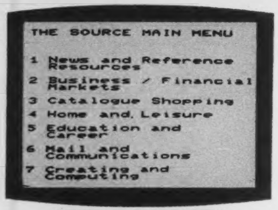

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  Communications
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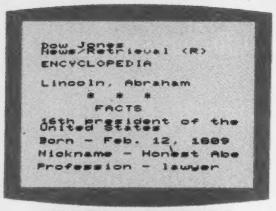

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Lincoln, Abraham
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      FACTS
16th president of the
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Nickname - Honest Abe
Profession - lawyer
```

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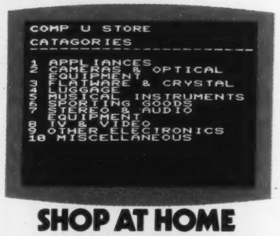

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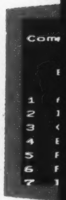

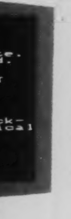

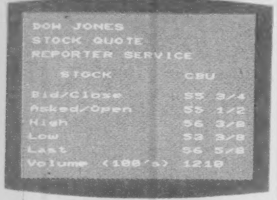

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   STOCK           CBU

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Asked/Open         55 1/2
High               56 3/8
Low                53 3/8
Last               56 5/8
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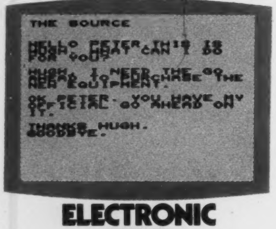

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HUGH. WHAT CAN I DO
FOR YOU?
HUGH, I NEED THE GO
AHEAD TO PURCHASE THE
NEW EQUIPMENT.
OK PETER. YOU HAVE MY
OFFICIAL GO AHEAD ON
IT.
THANKS HUGH.
GOODBYE.
```

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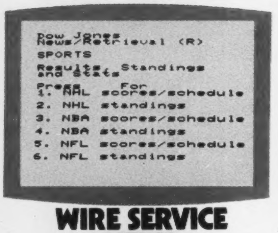

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4. NBA standings
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6. NFL standings
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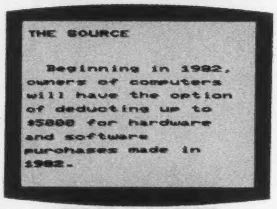

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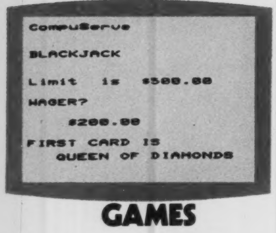

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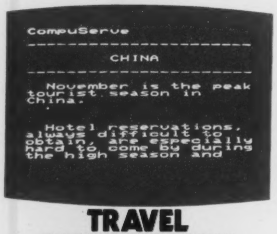

```
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------------------------------
           CHINA
------------------------------
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tourist season in
China.

  Hotel reservations,
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obtain, are especially
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the high season and
```

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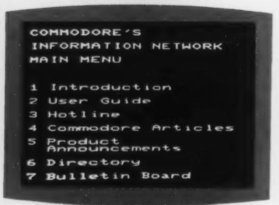

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  Announcements
6 Directory
7 Bulletin Board
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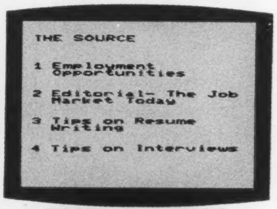

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3 Tips on Resume
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4 Tips on Interviews
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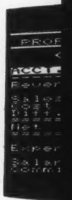

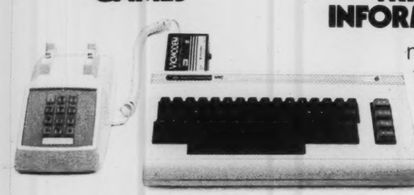

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CIRCLE 140 ON READER SERVICE CARD

Limits to Growth, continued...

```
 8030  RETURN
 8100  DATA 0,1,0.25,0,0.15,0.5,0.85,1,1,1,1,1,1
 8110  DATA 0,5,1,1.2,1,0.85,0.75,0.7,0.7,0.7,0.7,0.7,0.7
 8120  DATA 0,4.5,0.5,3,1.8,1,0.8,0.7,0.6,0.53,0.5,0.5,0.5
 8130  DATA 0,5,1,0.9,1,1.2,1.5,1.9,3,3,3,3,3
 8140  DATA 0,5,1,1.05,1,0.9,0.7,0.6,0.55,0.55,0.55,0.55,0.55
 8150  DATA 0,6,1,0.5,1,1.4,1.7,1.9,2.05,2.2,2.2,2.2,2.2
 8160  DATA 0,5,1,2.4,1,0.6,0.4,0.3,0.2,0.2,0.2,0.2,0.2
 8170  DATA 0,60,10,1.02,0.9,0.65,0.35,0.2,0.1,0.05,0.05,0.05,0.05
 8180  DATA 0,5,1,0.1,1,1.8,2.4,2.8,3,3,3,3,3
 8190  DATA 0,5,1,0.05,1,3,5.4,7.4,8,8,8,8,8
 8200  DATA 0,60,10,0.6,2.5,5,8,11.5,15.5,20,20,20,20
 8210  DATA 0,2,0.5,1,0.6,0.3,0.15,0.1,0.1,0.1,0.1,0.1,0.1
 8220  DATA 0,5,1,0.2,1,1.7,2.3,2.7,2.9,2.9,2.9,2.9,2.9
 8230  DATA 0,4.5,0.5,2,1.3,1,0.75,0.55,0.45,0.38,0.3,0.25,0.2
 8240  DATA 0,4,1,0,1,1.8,2.4,2.7,2.7,2.7,2.7,2.7,2.7
 8250  DATA 0,60,10,1.04,0.85,0.6,0.3,0.15,0.05,0.02,0.02,0.02,0.02
 8260  DATA 0,9,1,0,1,1.8,2.4,2.9,3.3,3.6,3.8,3.9,4
 8270  DATA 0,2,0.5,0.7,0.8,1,1.5,2,2,2,2,2,2
 8280  DATA 0,60,10,0.92,1.3,2,3.2,4.8,6.8,9.2,9.2,9.2,9.2
 8290  DATA 0,2,0.25,30,3,2,1.4,1,0.7,0.6,0.5,0.5,0.5
 8300  DATA 0,4,1,0,1,1.6,1.9,2,2,2,2,2,2
 8310  DATA 0,60,10,1.02,0.9,0.7,0.4,0.25,0.15,0.1,0.1,0.1,0.1
 9000  REM TABLE LOOKUP SUBROUTINE
 9010  IF IVAL<=TABLE(TAB,0) THEN
           DVAL=TABLE(TAB,3)
           :RETURN
 9020  IF IVAL>=TABLE(TAB,1) THEN
           DVAL=TABLE(TAB,12)
           :RETURN
 9030  INTVL=INT((IVAL-TABLE(TAB,0))/TABLE(TAB,2))
 9040  XLOI=TABLE(TAB,2)*INTVL
 9050  DVAL=TABLE(TAB,INTVL+3)+(TABLE(TAB,INTVL+4)-TABLE(TAB,INTVL+3))*(IVAL-XLOI
)/TABLE(TAB,2)
 9060  RETURN
 10000 REM SET UP PLOT
 10010 GOSUB 32000
 10020 SETCOLOR 0,1,10
       :SETCOLOR 1,5,10
       :SETCOLOR 2,10,10
 10030 COLOR 4
       :PLOT 9,0
       :PLOT 10,0
       :DRAWTO 10,160
       :PLOT 9,40
       :PLOT 9,80
       :PLOT 9,120
 10040 PLOT 10,160
       :DRAWTO 70,160
 10050 FOR I=16 TO 71 STEP 5
       :PLOT I,160
       :PLOT I,164
       :NEXT I
 10060 RETURN
 11000 REM DRAW DATA
 11005 X=10+(TIME-1900)/4
 11010 COLOR 10
       :Y=159-160*(P)/1E+10
       :GOSUB MARK
 11020 COLOR 8
       :Y=159-160*QL/2
       :GOSUB MARK
 11030 COLOR 7
       :Y=159-160*NR/1E+12
       :GOSUB MARK
 11040 COLOR 5
       :Y=159-160*POLR/40
       :GOSUB MARK
 11050 COLOR 9
       :Y=159-160*CI/2E+10
       :GOSUB MARK
 11060 COLOR 1
       :Y=159-160*FR/2
       :GOSUB MARK
 11800 RETURN
```

Limits to Growth, continued...

```
11900 IF Y<0 THEN
         Y=0
         :COLOR 0
11910 IF Y>159 THEN
         Y=159
11920 PLOT X,Y
      :RETURN
12000 REM PRINTER SET UP ROUTINE FOR MX-80
12010 DIM P$(130),B$(130)
      :FOR I=1 TO 130
       :B$(I,I)=" "
      :NEXT I
12020 LPRINT CHR$(15);CHR$(27);CHR$(85);CHR$(1);CHR$(27);CHR$(72);CHR$(27);"0"
12030 LPRINT "P=P,2=POLR,C=CI,F=FR,N=NR,Q=QL"
      :LPRINT
12040 LPRINT "          0.                 2.B                 4.B
   6.B                8.B P"
12050 LPRINT "          0.                 10.                 20.
   30.                40. 2"
12060 LPRINT "          0.                 5.B                10.B
  15.B               20.B C"
12070 LPRINT "          0.                  .5                 1.0
   1.5                2.0 F,Q"
12080 LPRINT "          0.               250.B               500.B
 750.B              1000.B N"
12100 RETURN
13000 REM PRINTER PLOT ROUTINE FOR MX-80
13010 IF INT(TIME/4)*4<>TIME THEN
         RETURN
13020 P$=B$
      :IF INT((TIME-100)/40)*40=TIME-100 THEN
         13050
13030 FOR I=11 TO 91 STEP 20
       :P$(I,I)="."
      :NEXT I
      :GOTO 13100
13050 P$(6,10)=STR$(TIME)
      :FOR I=11 TO 91 STEP 2
       :P$(I,I)="-"
      :NEXT I
13100 X=11+QL/0.025
      :IF X<92 THEN
         P$(X,X)="Q"
13110 X=11+NR/1.25E+10
      :IF X<92 THEN
         P$(X,X)="N"
13120 X=11+FR/0.025
      :IF X<92 THEN
         P$(X,X)="F"
13130 X=11+CI/250000000
      :IF X<92 THEN
         P$(X,X)="C"
13140 X=11+POLR/0.2
      :IF X<92 THEN
         P$(X,X)="2"
13150 X=11+P/100000000
      :IF X<92 THEN
         P$(X,X)="P"
13300 LPRINT P$
13310 RETURN
32000 REM SETS UP MULTI COLOR GRAPHICS MODE
32010 GRAPHICS 24
32020 DL=PEEK(560)+256*PEEK(561)
32030 POKE 559,0
32040 POKE DL+3,78
      :POKE DL+99,78
32050 FOR INSERT=DL+6 TO DL+98
32060  POKE INSERT,14
32070 NEXT INSERT
32080 FOR INSERT=DL+102 TO DL+198
32090  POKE INSERT,14
32100 NEXT INSERT
32110 POKE 87,10
32120 POKE 559,34
32130 RETURN
```

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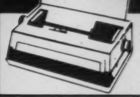

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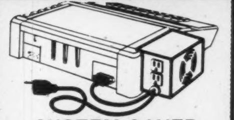

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A Comparison of Sorts, Revisited

Howard Kaplon

During a recent search for a better sorting routine, a colleague offered the article "A Comparison of Sorts" by John Grillo (Nov/Dec 1976—*Some people never discard their issues of Creative—EBS*). Previously, I had always used the bubble sort technique for exactly the reasons given in the Grillo article: it was a simple technique and one which was very familiar. According to the article, the Shell-Metzner sorting routine would end the search.

However, another colleague suggested that a technique called quicksort described in *The Art of Computer Programming*, Vol. III by Knuth be investigated. Having programmed this algorithm and modified it slightly, I wanted to see how it compared with the Shell-Metzner sort.

An empirical approach seemed the most direct way to compare the two sorting routines. The bubble sort was also included in the comparisons. At the end of this article (Listing 1) is the Basic program I used to make the comparisons. It is the Basic program given in "A Comparison of Sorts" that was modified for use on a Univac 1106 system and had the

Howard Kaplon, Towson State University, Towson, MD 21204.

Table I. Sort Execution Data.

		N						
Technique		**10**	**20**	**50**	**100**	**200**	**500**	**1000**
Bubble	T	17	70	379	1501	6241	38890	155642
	S	19	123	600	2329	9744	62181	252427
	C	45	190	1225	4950	19900	124750	499500
Shell-Metzner	T	15	42	125	302	948	2127	5280
	S	11	47	160	427	1050	2827	7415
	C	30	98	339	882	2162	6078	14890
Quicksort	T	12	29	98	233	505	1595	3526
	S	11	33	116	237	615	1851	4013
	C	22	69	286	790	1599	5443	12083

Table IA. Sort Execution Data.

		N		
Technique		**2000**	**3000**	**4000**
Shell-Metzner	T	13239	19503	33882
	S	17732	28725	49084
	C	34721	57173	87077
Quicksort	T	7541	11635	18227
	S	9175	14745	20310
	C	25195	38507	55549

quicksort technique appended to it.

Tables I and I-A summarize information on sorting arrays of 10, 20, 50, 100, 200, 500, and 1000 items by each of the three techniques. Additionally, arrays of 2000, 3000, and 4000 items were sorted by the Shell-Metzner and quicksort techniques. Each of the arrays consisted of a random sample generated from a normal distribution with a mean of 5000 and a standard deviation of 2000. The codes are: T = time of execution in milliseconds on a Univac 1106 time sharing system provided by the Maryland State Colleges Information Center, S = number of times that pairs of elements were switched, C = number of times that pairs of elements were compared, and N = number of items in the array.

As in the Grillo article, a regression model of the form $T = AN^B$ was used to predict the sorting time (T) from the array size (N). Table II gives the estimated regression equation for each of the three techniques. Using these equations and extrapolating, I calculated the predicted sorting times for large arrays as shown in Table III.

Differences between the values presented in Tables I, I-A and III of this article and the corresponding values that Grillo presented may be attributed to the different operating systems. However, the figures themselves are not nearly as important as the comparison among the three techniques.

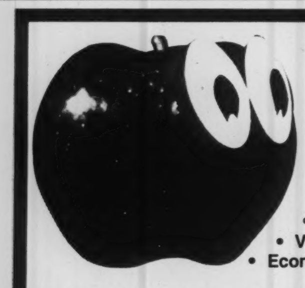
What has been accomplished? First of all, we see the logic of the quicksort algorithm is much clearer than that of the Shell-Metzner algorithm. Briefly, the quicksort routine chooses a pivot element (the first element in this case) of the array and divides the array into two subarrays such that the left subarray contains all of the elements that are less than the pivot. The larger of the subarrays is put on a stack. The smaller subarray is further divided by its pivot into two subarrays. This process is repeated with each larger subarray being put on the stack until a smaller subarray has fewer than ten elements. This subarray is then bubble sorted, and the last subarray on the stack

Table II. Estimated Regression Equations.

Technique	Number of Data Points	$T = AN^B$
Bubble	7	$T = 0.176N^{1.978}$
Shell-Metzner	10	$T = 0.924N^{1.259}$
Quicksort	10	$T = 0.821N^{1.206}$

Table III. Extrapolated Predicted Sorting Times.

Array Size	Technique		
N	Bubble	Shell-Metzner	Quicksort
10,000	3.99 hours	1.67 minutes	0.91 minutes
100,000	15.81 days	30.37 minutes	14.66 minutes
1,000,000	4.13 years	9.19 hours	3.93 hours
10,000,000	392.55 years	6.95 days	2.63 days



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The DS-65 Digisector® opens up a whole new world for your Apple II. Your computer can now be a part of the action, taking pictures to amuse your friends, watching your house while you're away, taking computer portraits . . . the applications abound! The DS-65 is a random access video digitizer. It converts a TV camera's output into digital information your computer can process. The DS-65 features:

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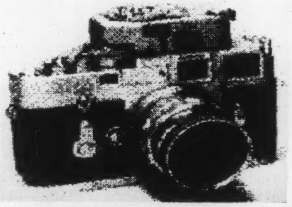

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—**Portrait System Software:** This program includes captions and a credit line, reverse printing for T-shirt application and the option to save portraits on disk. Specifically for use with a Malibu 165 printer. Call or write for more information.

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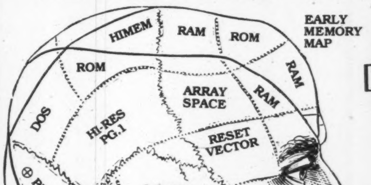

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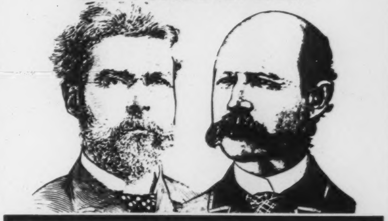

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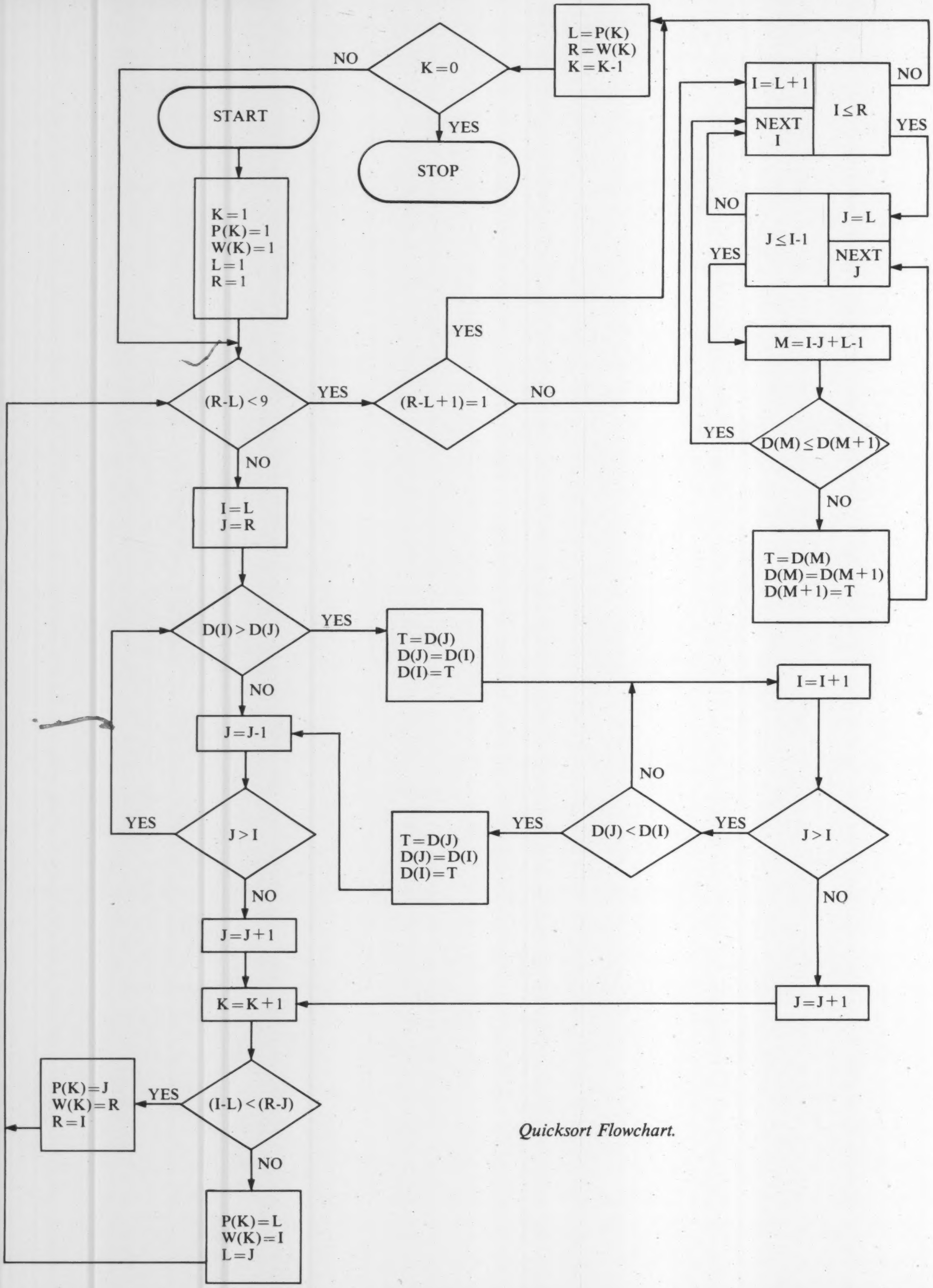
START
K=1
P(K)=1
W(K)=1
L=1
R=1
(R-L)<9
YES
NO
(R-L+1)=1
YES
NO
K=0
YES
NO
STOP
L=P(K)
R=W(K)
K=K-1
I=L+1
NEXT
I
I≤R
NO
YES
J≤I-1
J=L
NEXT
J
NO
YES
M=I-J+L-1
D(M)≤D(M+1)
YES
NO
T=D(M)
D(M)=D(M+1)
D(M+1)=T
I=L
J=R
D(I)>D(J)
YES
NO
T=D(J)
D(J)=D(I)
D(I)=T
I=I+1
J=J-1
J>I
YES
NO
J>I
YES
NO
D(J)<D(I)
YES
NO
T=D(J)
D(J)=D(I)
D(I)=T
J=J+1
J=J+1
K=K+1
(I-L)<(R-J)
YES
NO
P(K)=J
W(K)=R
R=I
P(K)=L
W(K)=I
L=J

Quicksort Flowchart.

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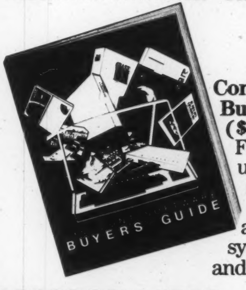

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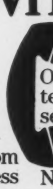

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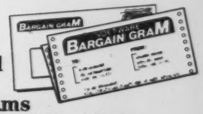

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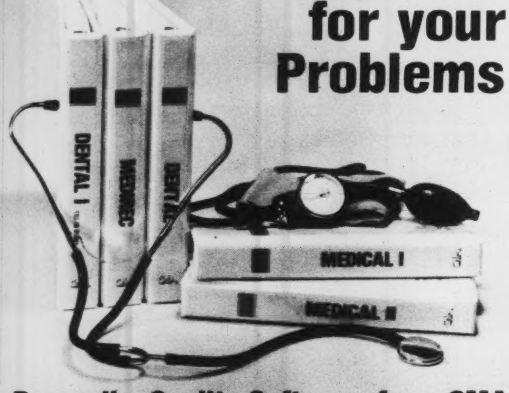

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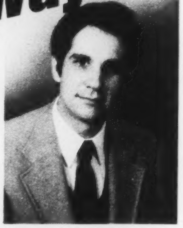

says Q-PRO 4 user,
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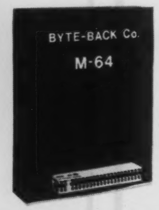

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Comparison of Sorts, continued...

is examined. It is either divided or bubble sorted depending on whether it has at least ten or fewer than ten elements. Since all of the elements in each subarray are less than all of the elements in the next subarray to the right, after each subarray has been sorted, the sorted subarrays form the complete sorted array.

Secondly, one may compare the sorting times of the three techniques. Using the equations in Table II, I estimated that quicksort is $0.214N^{0.772}$ times as fast as the bubble sort and $1.125N^{0.053}$ times as fast as the Shell-Metzer sort. From these estimates one may conclude that quicksort has the fastest sorting execution time and as the size of the array increases, the advantages of quicksort over the other two sorts also increase.

Finally, Harold Lorin indicates that quicksort with some minor modifications, as done by Richard C. Singleton, on the choice of the pivot and the sorting technique for the subarrays with less than ten elements may be the fastest of the currently known sorting techniques.

Since there is some theory to indicate that the sorting times of the bubble sort, Shell-Metzner sort, and quicksort are proportional to N^2, Nln(N), and Nln(N) respectively, alternate regression models of $T = KN^2$, $T = KN\ln(N)$, and $T = KN\ln(N)$ respectively were set up. For all three techniques, the estimated regression equations were computed using the seven data points. Then, with the additional data

Producing a Frequency Table

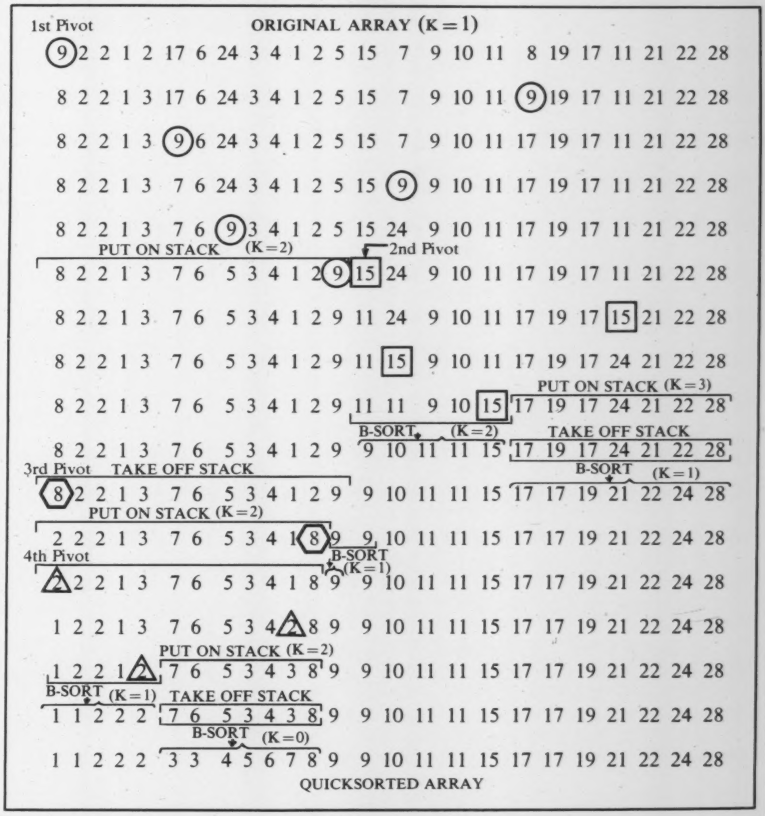
One of the more common applications of numeric sorting is its use in producing a frequency table. Frequency tables are very useful when analyzing many different situations from inventory data to school test scores. Tables may be constructed by creating a new category each time a new value appears in the list. However, these categories are rarely in sorted order, and this procedure is inefficient when there are more than a few categories. On the other hand if the data list can be efficiently sorted, a frequency table can be constructed easier, faster and in increasing categorical order. The quicksort technique accomplishes this task.

To understand how quicksort works, consider an example. Suppose the list consists of the test scores of 500 students whose records are arranged in alphabetical order according to the students' last names. The first student's score is used as a pivot. It is compared to scores at the end of the alphabetical list beginning with the last score then the next to last score, etc., until a score smaller than the pivot is located. Call this the rth score. The pivot and this score are interchanged. Now compare the pivot with the second, third, etc., score until a score larger than the pivot is found. Call this the kth score. The pivot and this score are interchanged. Next the pivot is compared to the (r-l)st, (r-2)nd, etc. score until a score smaller than the pivot is found. The pivot and this score are interchanged. This process—comparing the pivot to right end scores and working toward the center until a smaller score is found, interchanging, comparing the pivot to left end scores and working toward the center until a larger score is found, interchanging, and continuing to alternate comparing the pivot with right and left side scores always working toward the center—is continued until all scores have been compared with the pivot. The pivot is now in the pth position of the list. At this point, the scores will be arranged such that all of the scores smaller than or equal to the pivot will be in the first p positions of the list, and the last (500-p) scores in the list will be greater than the pivot.

The entire list has been subdivided into two sublists; one being the first p scores, and the second consisting of the last (500-p) scores. These sublists are further subdivided in the same manner (choosing the first score in each sublist as the pivot for that sublist). Each time, all of the sublists are in increasing order as groups, however the scores within each sublist are not sorted. When a sublist is produced that has fewer than ten scores, it is bubble sorted in its present position in the entire list. After each has been subdivided into fewer than ten scores and bubble sorted, the entire list is sorted into increasing order.

A frequency table may now be easily constructed by going through the list starting at the first position, incrementing the first counter by one until a nonequal score appears, incrementing the next counter by one until a nonequal score appears, etc., until the list is exhausted.

Step by step example of the quicksort algorithm.


1st Pivot
ORIGINAL ARRAY (K=1)
9 2 2 1 2 17 6 24 3 4 1 2 5 15 7 9 10 11 8 19 17 11 21 22 28
8 2 2 1 3 17 6 24 3 4 1 2 5 15 7 9 10 11 9 19 17 11 21 22 28
8 2 2 1 3 9 6 24 3 4 1 2 5 15 7 9 10 11 17 19 17 11 21 22 28
8 2 2 1 3 7 6 24 3 4 1 2 5 15 9 9 10 11 17 19 17 11 21 22 28
8 2 2 1 3 7 6 9 3 4 1 2 5 15 24 9 10 11 17 19 17 11 21 22 28
PUT ON STACK (K=2)
2nd Pivot
8 2 2 1 3 7 6 5 3 4 1 2 9 15 24 9 10 11 17 19 17 11 21 22 28
8 2 2 1 3 7 6 5 3 4 1 2 9 11 24 9 10 11 17 19 17 15 21 22 28
8 2 2 1 3 7 6 5 3 4 1 2 9 11 15 9 10 11 17 19 17 24 21 22 28
PUT ON STACK (K=3)
8 2 2 1 3 7 6 5 3 4 1 2 9 11 11 9 10 15 17 19 17 24 21 22 28
B-SORT (K=2)
TAKE OFF STACK
8 2 2 1 3 7 6 5 3 4 1 2 9 9 10 11 11 15 17 19 17 24 21 22 28
3rd Pivot
TAKE OFF STACK
B-SORT (K=1)
8 2 2 1 3 7 6 5 3 4 1 2 9 9 10 11 11 15 17 17 19 21 22 24 28
PUT ON STACK (K=2)
2 2 2 1 3 7 6 5 3 4 1 8 9 9 10 11 11 15 17 17 19 21 22 24 28
4th Pivot
B-SORT (K=1)
2 2 2 1 3 7 6 5 3 4 1 8 9 9 10 11 11 15 17 17 19 21 22 24 28
1 2 2 1 3 7 6 5 3 4 2 8 9 9 10 11 11 15 17 17 19 21 22 24 28
PUT ON STACK (K=2)
1 2 2 1 2 7 6 5 3 4 3 8 9 9 10 11 11 15 17 17 19 21 22 24 28
B-SORT (K=1)
TAKE OFF STACK
1 1 2 2 2 7 6 5 3 4 3 8 9 9 10 11 11 15 17 17 19 21 22 24 28
B-SORT (K=0)
1 1 2 2 2 3 3 4 5 6 7 8 9 9 10 11 11 15 17 17 19 21 22 24 28
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Comparison of Sorts, continued...

Table IV. Alternative Estimated Regression Equations.

Technique	Number of Data Points	Sorting Time Function
Bubble	7	$T = 0.156\ N^2$
Shell-Metzner	7	$T = 0.753\ N\ln(N)$
Shell-Metzner	8	$T = 0.847\ N\ln(N)$
Shell-Metzner	9	$T = 0.824\ N\ln(N)$
Shell-Metzner	10	$T = 0.934\ N\ln(N)$
Quicksort	7	$T = 0.510\ N\ln(N)$
Quicksort	8	$T = 0.499\ N\ln(N)$
Quicksort	9	$T = 0.489\ N\ln(N)$
Quicksort	10	$T = 0.523\ N\ln(N)$

Table V. Average Alternative Estimated Regression Equations.

Technique	Sorting Time Function	Standard Deviation of the Coefficient K
Bubble	$T = 0.156\ N^2$	
Shell-Metzner	$T = 0.840\ N\ln(N)$	0.065
Quicksort	$T = 0.505\ N\ln(N)$	0.013

Table VI. Alternative Extrapolated Predicted Sorting Times.

Array Size	Technique		
N	Bubble	Shell-Metzner	Quicksort
10,000	4.33 hours	1.29 minutes	0.78 minutes
100,000	10.06 days	16.12 minutes	9.69 minutes
1,000,000	4.96 years	3.22 hours	1.94 hours
10,000,000	496.03 years	1.57 days	0.94 days

when N = 2000, 3000, and 4000 added one point at a time, three additional estimated regression equations were computed for each of the Shell-Metzner and quicksort techniques. These equations are given in Table IV. For the Shell-Metzner and quicksort techniques, the four estimated values of K were averaged. These average estimated regression equations, the standard deviations of K, and the equation for the bubble sorting time are given in Table V. The extrapolated sorting times for large arrays are shown in Table VI.

The conclusions that may be drawn from Table V are very similar to those already drawn from Table II, except that quicksort is now predicted to be a constant 1.663 times as fast as Shell-Metzner. However, I think that the values of extrapolated predicted sorting times in Table VI are more accurate than those in Table III when executed on the Univac 1106.

In conclusion, while the understanding of the logic of the Shell-Metzner sort algorithm provides an interesting exercise, and while its sorting time is faster than that of the bubble sort, the delayed replacement sort and several other techniques, it is less efficient than quicksort. And so it seems that when internal sorting techniques are discussed, quicksort should be among those presented. Among the advantages of quicksort are: it allows for experimentation with different simple sorting routines for the subarrays of fewer than ten elements; it allows for variation in the number of elements at which the smaller subarray is to be bubble or otherwise simple sorted to optimize the execution time on each operating system; and it is easily programmed, clear, and quick. □

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00140 PRINT
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CIRCLE 118 ON READER SERVICE CARD

Comparison of Sorts, continued...

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00170 IF S$<>'YES' GO TO 270
00180 PRINT
00190 PRINT 'SELECT SORTING ALGORITHM'
00200 PRINT
00210 PRINT 'TYPE      TO USE'
00220 PRINT ' B         BUBBLE SORT'
00230 PRINT ' R         DELAYED REPLACEMENT'
00240 PRINT ' S         SHELL - METZNER'
00250 PRINT ' K         QUICKSORT'
00260 INPUT S$
00270 PRINT
00280 PRINT 'TYPE THE FOLLOWING: SAMPLE SIZE, MEAN, STD. DEV.'
00290 S2=S4=F=0
00300 X1=TIM
00310 INPUT Y,M,S
00320 IF Y<=4000 GO TO 370
00330 PRINT 'MAXIMUM SIZE = 4000'
00340 GO TO 280
00350 REM
00360 REM
00370 REM COMPUTE RANDOM NOS. USING CENTRAL LIMIT THEOREM TECHNIQUE
00380 FOR N=1 TO Y
00390 R=0
00400 FOR J=1 TO 12
00410 R=R+RND
00420 NEXT J
00430 R=M+S*(R-6)
00440 D(N)=INT(R)
00450 S2=S2+D(N)
00460 S4=S4+D(N)*D(N)
00470 NEXT N
00480 X2=TIM-X1
00490 PRINT
00500 PRINT
00510 PRINT
00520 PRINT Y;' RANDOM NUMBERS GENERATED IN';X2;' SECONDS.'
00530 PRINT
00540 PRINT
00550 M2=S2/Y
00560 V2=S4-M2*S2
00570 V2=V2/(Y-1)
00580 PRINT 'MEAN = ';M2;
00590 PRINT ', STD. DEV. = ';SQR(V2)
00600 PRINT
00610 PRINT
00620 PRINT 'WHAT FORM OF OUTPUT DO YOU WANT?'
00630 PRINT
00640 PRINT 'TYPE    IF YOU WANT'
00650 PRINT ' G        HISTOGRAM ON TTY'
00660 PRINT ' T        NUMBERS ON TTY'
00670 PRINT ' F        NUMBERS ON FILE'
00680 PRINT ' TS       NUMBERS ON TTY, SORTED'
00690 PRINT ' FS       NUMBERS ON FILE, SORTED'
00700 INPUT Q$
00710 C$=CPY$(Q$,1,1)
00720 D$=CPY$(Q$,LEN(Q$),1)
00730 IF C$<>'F' GO TO 810
00740 PRINT
00750 PRINT 'A TEMPORARY FILE OF THE FORM: YOUR PROJECT-ID*F$.'
00760 PRINT 'HAS BEEN ASIGNED TO THIS RUN.   TO PRINT THE CONTENTS'
00770 PRINT 'OF THIS FILE, YOU MUST EXIT THE BASIC COMPILER AND'
00780 PRINT 'USE THE @ED F$. OR @DATA,L F$. COMMANDS.'
00790 PRINT
00800 OPEN F$ FOR TEMPORARY OUTPUT AS FILE 1
00810 IF Q$<>'G' GO TO 860
00820 IF F=1 GO TO 840
00830 GOSUB 1470
00840 GOSUB 1260
00850 GO TO 1120
00860 IF D$<>'S' GO TO 890
00870 IF F=1 GO TO 890
00880 GOSUB 1470
00890 IF C$<>'F' GO TO 990
00900 FOR A=1 TO Y STEP 10
00910 FOR B=A TO A+9
00920 IF B>Y GO TO 1120
00930 WRITE ON 1: D(B);
00940 NEXT B
00950 WRITE ON 1:
00960 NEXT A
00970 CLOSE 1
00980 GO TO 1140
00990 IF C$='T' GO TO 1040
01000 IF LEN(Q$)>0 GO TO 1020
01010 STOP
01020 PRINT 'IMPROPER OUTPUT CODE, TRY AGAIN!'
01030 GO TO 600
01040 PRINT
```

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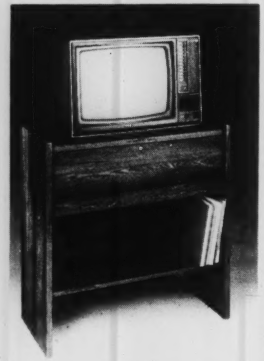

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Comparison of Sorts, continued...

```
01050 FOR A=1 TO Y STEP 10
01060 FOR B=A TO A+9
01070 IF B>Y GO TO 1120
01080 PRINT D(B);
01090 NEXT B
01100 PRINT
01110 NEXT A
01120 PRINT
01130 PRINT
01140 PRINT 'DIFFERENT OUTPUT?'
01150 INPUT Q$
01160 IF Q$='YES' GO TO 630
01170 IF Q$<>'NO' GO TO 710
01180 PRINT
01190 PRINT 'DO YOU WANT ANOTHER SET OF NUMBERS?'
01200 INPUT T$
01210 IF T$='YES' GO TO 270
01220 STOP
01230 REM
01240 REM
01250 REM GRAPHING ROUTINE
01260 L=D(1)
01270 H=D(Y)
01280 I=(H-L)/30
01290 PRINT
01300 PRINT 'GRAPH OF';Y;' NUMBERS PRODUCED,
      FROM';L;' TO';H;' BY';
01310 PRINT MAX(1,I)
01320 PRINT
01330 PRINT
01340 B=1
01350 FOR A=L TO (H+MAX(1,I)) STEP MAX(1,I)
01360 PRINT INT(A),
01370 IF D(B)<D(B-1) GO TO 1440
01380 IF D(B)>A GO TO 1420
01390 PRINT '*';
01400 B=B+1
01410 GO TO 1370
01420 PRINT
01430 NEXT A
01440 PRINT
01450 PRINT
01460 RETURN
01470 REM SORTING ROUTINE
01480 PRINT
01490 F=1
01500 X1=TIM
01510 IF S$='R' GO TO 1780
01520 IF S$='B' GO TO 1580
01530 IF S$='K' GO TO 2220
01540 GO TO 1990
01550 REM
01560 REM
01570 REM BUBBLE SORT
01580 PRINT 'BUBBLE SORT ALGORITHM'
01590 N7=C7=0
01600 FOR A=1 TO Y-1
01610 FOR B=A+1 TO Y
01620 C7=C7+1
01630 IF D(A)<D(B) GO TO 1680
01640 N7=N7+1
01650 T=D(A)
01660 D(A)=D(B)
01670 D(B)=T
01680 NEXT B
01690 NEXT A
01700 X2=TIM-X1
01710 PRINT X2;' SECONDS SORTING TIME'
01720 PRINT N7;' SWITCHES EXECUTED'
01730 PRINT C7;' COMPARISONS EXECUTED'
01740 PRINT
01750 RETURN
01760 REM
01770 REM
01780 REM DELAYED REPLACEMENT SORT
01790 PRINT 'DELAYED REPLACEMENT SORT ALGORITHM'
01800 N7=C7=0
01810 J7=K7=L7=0
01820 L7=L7+1
01830 IF L7=Y GO TO 1700
01840 J7=L7
01850 K7=J7+1
01860 C7=C7+1
01870 IF D(K7)>D(J7) GO TO 1890
01880 J7=K7
01890 K7=K7+1
01900 IF K7<=Y GO TO 1860
01910 IF L7=J7 GO TO 1820
01920 N7=N7+1
```

```
01930 T=D(J7)
01940 D(J7)=D(L7)
01950 D(L7)=T
01960 GO TO 1820
01970 REM
01980 REM
01990 REM SHELL - METZNER SORT
02000 PRINT 'SHELL - METZNER SORT'
02010 N7=C7=0
02020 M6=Y
02030 M6=INT(M6/2)
02040 IF M6=0 GO TO 1700
02050 K6=Y-M6
02060 J6=1
02070 I6=J6
02080 L6=I6+M6
02090 C7=C7+1
02100 IF D(I6)<=D(L6) GO TO 2170
02110 N7=N7+1
02120 T=D(I6)
02130 D(I6)=D(L6)
02140 D(L6)=T
02150 I6=I6-M6
02160 IF I6>=1 GO TO 2080
02170 J6=J6+1
02180 IF J6>K6 GO TO 2030
02190 GO TO 2070
02200 REM
02210 REM
02220 REM QUICKSORT
02230 PRINT 'QUICKSORT ALGORITHM'
02240 N7=C7=0
02250 K8=1
02260 P(K8)=1
02270 W(K8)=Y
02280 L8=1
02290 R8=Y
02300 IF (R8-L8)<9 GO TO 2640
02310 I8=L8
02320 J8=R8
02330 C7=C7+1
02340 IF D(I8)>D(J8) GO TO 2440
02350 J8=J8-1
02360 IF J8>I8 GO TO 2330
02370 J8=J8+1
02380 K8=K8+1
02390 IF (I8-L8)<(R8-J8) GO TO 2600
02400 P(K8)=L8
02410 W(K8)=I8
02420 L8=J8
02430 GO TO 2300
02440 N7=N7+1
02450 T=D(J8)
02460 D(J8)=D(I8)
02470 D(I8)=T
02480 GO TO 2510
02490 C7=C7+1
02500 IF D(J8)<D(I8) GO TO 2550
02510 I8=I8+1
02520 IF J8>I8 GO TO 2490
02530 J8=J8+1
02540 GO TO 2380
02550 N7=N7+1
02560 T=D(J8)
02570 D(J8)=D(I8)
02580 D(I8)=T
02590 GO TO 2350
02600 P(K8)=J8
02610 W(K8)=R8
02620 R8=I8
02630 GO TO 2300
02640 IF (R8-L8+1)=1 GO TO 2760
02650 FOR I8=(L8+1) TO R8
02660 FOR J8=L8 TO (I8-1)
02670 J9=I8-J8+L8-1
02680 C7=C7+1
02690 IF D(J9)<=D(J9+1) GO TO 2750
02700 N7=N7+1
02710 T=D(J9)
02720 D(J9)=D(J9+1)
02730 D(J9+1)=T
02740 NEXT J8
02750 NEXT I8
02760 L8=P(K8)
02770 R8=W(K8)
02780 K8=K8-1
02790 IF K8=0 GO TO 1700
02800 GO TO 2300
02810 END
```

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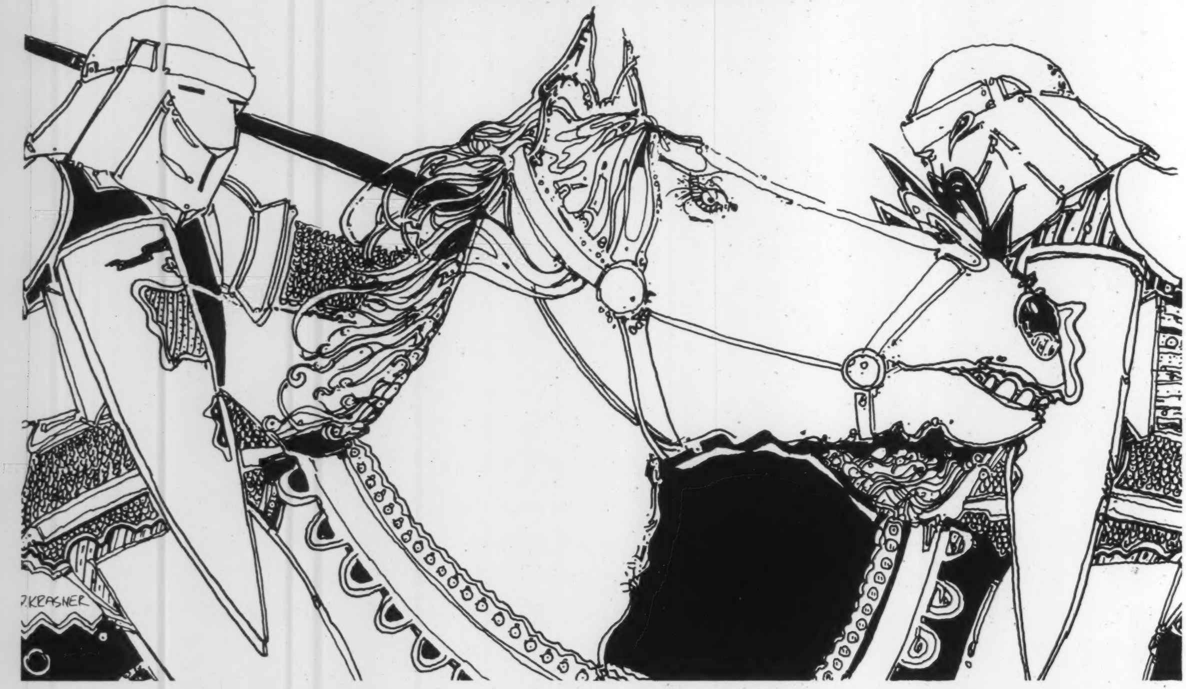
Medieval Combat



Fred Pinho

Medieval Combat is a strategy game for the Atari which requires 32K for cassette and 40K for disk.

The game is the medieval equivalent of "This town ain't big enough for both of us, pahdner!" You and your opponent are superpowers surrounded by lesser kingdoms. The enmity between your two countries is so great that neither can allow the other to survive.

The game universe consists of eight kingdoms. The castle and armies of the two opponents are in red and blue. Other kingdoms are in brown.

Initially, each opponent has 12 armies at his command; four each of archers, cavalry and infantry. The muster strength of each army is displayed in the first two lines of the text window (red is on the top line). These are updated after each battle. The combat strengths of the other (brown) kingdoms are assigned randomly. Since the peasants in these kingdoms are loyal, you cannot find out the strength of the brown armies before you attack.

Your fighting or effective strength depends on the type of battle fought and the army type as shown in Figure 1. Infantry were not very effective in open-country warfare during this era. The armored knight still reigned supreme. On the other hand, knights were not too useful when laying siege to fixed fortifications. If you attack a neutral (brown) kingdom, you must win by besieging the castle. Battles between the red and blue armies take place in open country.

The outcome of the battle depends on the strength of the opposing forces. If the forces are closely matched, the battle will be indecisive, losses will be heavy, and both sides will be forced to retreat. If you can set your strategy so that your forces are greater than those of your enemy, then your losses will be reduced. If you can overwhelm your opponent, you will destroy his armies. In addition, you will also further reduce your losses by recruiting a proportion of your foe's demoralized and discouraged soldiers.

Here, as in real life, it is considered very bad form to lose your "home" kingdom. If this happens, a significant proportion of your subjects become disillusioned with your incompetence. They defect to your opponent providing him with sorely needed reinforcements. You also become nameless, being referred to solely by your color. This is a great humiliation for someone with your drive, ambition and ego.

Figure 1.

	Multiplier of Muster Strength per Battle Type	
Army Type	**Siege of Castle**	**Open Country**
Cavalry	0.4	0.9
Archers	0.8	0.7
Infantry	0.8	0.5

Fred Pinho, 676 Rollingwood Way, Valley Cottage, NY 10989.

If both kings invade a neutral kingdom, the initial battle is between the forces of the two kings. However, the native forces immediately attack the victor in the hope of catching his armies while still weak and in disarray from the first battle.

During your campaign, you may be beset by natural disasters (illness, floods, etc.). No one said that war was a piece of cake. Also, you must constantly be on the alert for rebel attacks. Once you conquer a kingdom, the losers form a rebel army which will quickly attack should you display any weakness.

Type RUN and the program asks for the name of each king. Then the screen goes blank for a few seconds while the computer defines a new character set. The kingdom map is then drawn and the war begins.

The computer flashes each army on and off, in turn, while asking for your move. Type the first letter of the kingdom you wish to move to. It is not necessary to hit RETURN. To keep an army in place, type any number or letter key other than those of the kingdoms (i.e. A,B,C,G,N,P,S,V). The space bar is also OK. Each kingdom is labelled on the TV display.

Your forces are too massive to allow movement over the mountains or through the forests. They can move only via specific passes through these obstacles. The computer tells you if your move is illegal.

Note that within each army type, each army is identified by a dot. These dots identify the army number as follows:

1 ■ ■ 4   2 ■ ■ 3

Since these dots are hard to see, the computer flashes the army when requesting battle commands.

It is necessary for the opponent to look away while the first player makes his moves. If you suspect that your opponent is cheating, you can try to outfox him by typing a key close to that of a kingdom's key. In this way, you can also exercise the diplomatic craft of deviousness along with your battle skills.

After all moves are entered, the computer moves the armies and the battle begins.

You can conquer your known world in two ways. If you can control a total of four kingdoms, your influence will be so great that your opponents will give up the fight. Alternately you can destroy your opponent's armies until their strength is so low that they will surrender and pledge their allegiance to your banner. Should you be so evenly

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matched that both armies are reduced to near zero, the game will end due to the exhaustion of your soldiers.

The Program

The program structure is shown in Figure 2.

The program makes use of two character sets. The standard one is stored in ROM beginning at memory location 57344. To form the second character set, the first half of the ROM-based set (512 bytes) is moved into RAM (lines 32000-32020). The location chosen was just beneath the Graphics 1 display list.

Then the punctuation characters are redefined into the army and landscape characters (lines 32030-32040, 32100-32123). To make use of the two sets, a display list interrupt is set at the last line of the Gr.1 display. Finally, a short machine language program is used to switch between the two character sets (lines 32050-32060, 32125).

Note that the machine language program, used to move the ROM-based set into RAM, is stored as graphics characters within a string (CHAR $ in line 32020). Since, the printer will not print graphics characters, type the string as shown in Figure 3.

I hope you enjoy this game as much as I enjoyed programming it. May all your campaigns be successful and may you rule your realm long and wisely. ☐

Figure 2.

Lines	Purpose
10-240	Initialization and initial display
275-1292	Subroutines
1740-2980	Main game loop
3000-3617	Subroutines
9000-9220	Data statements
32000-32125	Subroutine and data for redefining the character set and setting up a display list interrupt.

Figure 3.

Character Position in String	Type	Seen on Screen
1	Lower-case H	h
2	Inverse)	Inverse)
3	Control comma	Graphics heart
4	Inverse control E	Inverse graphics character
5	Inverse M	Inverse M
6	Inverse)	Inverse)
7	Inverse control period	Inverse graphics diamond
8	Inverse control E	Inverse graphics character
9	Inverse N	Inverse N
10	Inverse l	Inverse l
11	Inverse M	Inverse M
12	Inverse control Q	Inverse graphics character
13	Inverse K	Inverse K
14	Inverse H	Inverse H
15	Inverse P	Inverse P
16	Inverse lower-case Y	Inverse y
17	Inverse lower-case F	Inverse f
18	Inverse L	Inverse L
19	Inverse lower-case F	Inverse f
20	Inverse N	Inverse N
21	Inverse %	Inverse %
22	Inverse N	Inverse N
23	Inverse I	Inverse I
24	Inverse lower-case B	Inverse b
25	Inverse P	Inverse P
26	Inverse lower-case M	Inverse m
27	Control period	Graphics diamond

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CIRCLE 303 ON READER SERVICE CARD

```
10 DIM KD(9,7),KS(3,7),RA(5,11),BA(5,11),NA(7),RBA(7),TE(1,11)
20 DIM EN$(48),MVR$(12),MVB$(12),MV0$(12),M1$(1),KD$(8),NMR$(9),NMB$(9),HLD$(8),
PL$(1),J$(8),NUMBER$(24)
25 DIM ARMY$(24),BLK$(39),NAMER$(25),NAMEB$(25),LOGO$(35),WN$(9),LS$(9)
30 BLK$="                                        ":EN$="23999925999901499904699923
5679147999347999456999"
35 NUMBER$="FIRST SECONDTHIRD FOURTH":ARMY$="CAVALRY ARCHERS INFANTRY":MV0$="999
999999999"
40 GRAPHICS 1:LOGO$="                   MEDIEVAL  COMBAT ":FOR L=1 TO 18:POSITION
 1,8:? #6;LOGO$(L,L+17):COLOR 138
42 PLOT 0,7:DRAWTO 19,7:DRAWTO 19,9:DRAWTO 0,9:DRAWTO 0,8
43 SOUND 0,L*14,10,14:SOUND 1,L*14-1,10,12:SETCOLOR 3,INT(RND(0)*16),4:GOSUB 685
:SETCOLOR 3,INT(RND(0)*16),6
44 GOSUB 685:NEXT L:SOUND 0,0,0,0:SOUND 1,0,0,0:POKE 711,70:E=280:F=290:G=680
50 NAMER$="":? "My lord! You will command the red":? "armies. Choose your royal
title!":INPUT NAMER$
55 IF NAMER$="" THEN NAMER$="Red Sire"
60 NAMEB$="":? :? :? :? "My liege! You will command the blue":? "armies. Choose
your royal title!":INPUT NAMEB$
65 IF NAMEB$="" THEN NAMEB$="Blue Sire"
200 GOSUB 32000:POKE 559,34:POKE 708,38:POKE 82,1
240 GOSUB 3000:GOSUB 3100:GOSUB 3150:GOSUB 3200:GOSUB 3500:GOTO 1740
275 J$="12403576":RETURN
276 J$="70612453":RETURN
277 J$="43526071":RETURN
280 POKE 656,2:POKE 657,1:RETURN
290 POKE 656,3:POKE 657,1:RETURN
300 ADD=0:SMW=0:SMLR=0:SMLB=0:IF RES>=1.2 THEN 325
305 IF B THEN M=0.85:GOSUB 1060:GOSUB 820:IF TESR>TESB AND TESB>0 THEN M=0.94:GO
SUB 1060
310 IF R THEN M=0.85:GOSUB 1050:GOSUB 800:IF TESB>TESR AND TESR>0 THEN M=0.94:GO
SUB 1050
315 IF N THEN NA(J)=0.85*NA(J)
320 GOTO 565
325 IF RES>=1.5 THEN 360
330 IF B=10 THEN M=0.9:GOSUB 1060:IF R=1 THEN M=0.7:GOSUB 1050:GOSUB 800:GOTO 56
5
335 IF B=10 THEN IF N=1 THEN RBA(J)=0.7*NA(J):NA(J)=0:GOTO 565
340 IF R=10 THEN M=0.9:GOSUB 1050:IF B=1 THEN M=0.7:GOSUB 1060:GOSUB 820:GOTO 56
5
345 IF R=10 THEN IF N=1 THEN RBA(J)=0.7*NA(J):NA(J)=0:GOTO 565
350 IF N=10 THEN NA(J)=0.9*NA(J):IF B=1 THEN M=0.7:GOSUB 1060:GOSUB 820:GOTO 565
355 IF N=10 THEN IF R=1 THEN M=0.7:GOSUB 1050:GOSUB 800:GOTO 565
360 IF R<10 THEN 390
370 V=0:GOSUB 1120
375 IF B=0 THEN 445
385 GOSUB 1130:GOTO 445
390 IF B<10 THEN 420
400 V=1:GOSUB 1120
405 IF R=0 THEN 445
415 GOSUB 1140:GOTO 445
420 IF R=0 THEN 440
430 GOSUB 1140:GOTO 445
440 GOSUB 1130
445 IF RES>=2 THEN 495
450 IF B=10 THEN M=0.9:GOSUB 1060:IF R=1 THEN ADD=(SMLR*0.2)/SMW:V=1:GOSUB 1070:
M=0.5:GOSUB 1050
456 IF B=10 THEN IF R=1 THEN GOSUB 800:GOTO 565
460 IF B=10 THEN IF N=1 THEN ADD=(NA(J)*0.3)/SMW:V=1:GOSUB 1070:RBA(J)=0.5*NA(J)
:NA(J)=0:GOTO 565
465 IF R=10 THEN M=0.9:GOSUB 1050:IF B=1 THEN ADD=(SMLB*0.2)/SMW:V=0:GOSUB 1070
471 IF R=10 THEN IF B=1 THEN M=0.5:GOSUB 1060:GOSUB 820:GOTO 565
475 IF R=10 THEN IF N=1 THEN ADD=(NA(J)*0.3)/SMW:V=0:GOSUB 1070:RBA(J)=0.5*NA(J)
:NA(J)=0:GOTO 565
480 IF N=10 THEN NA(J)=0.9*NA(J):IF B=1 THEN NA(J)=NA(J)+SMLB*0.2
481 IF N=10 THEN IF B=1 THEN M=0.5:GOSUB 1060:GOSUB 820:GOTO 565
485 IF N=10 THEN IF R=1 THEN NA(J)=NA(J)+SMLR*0.2:M=0.5:GOSUB 1050:GOSUB 800:GOT
O 565
495 IF B=10 THEN M=0.9:GOSUB 1060:IF R=1 THEN ADD=(SMLR*0.4)/SMW:V=1:GOSUB 1070:
M=0.01:GOSUB 1050:GOTO 565
505 IF B=10 THEN IF N=1 THEN ADD=(NA(J)*0.5)/SMW:V=1:GOSUB 1070:NA(J)=0:GOTO 565
510 IF R=10 THEN M=0.9:GOSUB 1050:IF B=1 THEN ADD=(SMLB*0.4)/SMW:V=0:GOSUB 1070:
M=0.01:GOSUB 1060:GOTO 565
520 IF R=10 THEN IF N=1 THEN ADD=(NA(J)*0.5)/SMW:V=0:GOSUB 1070:NA(J)=0:GOTO 565
525 IF N=10 THEN NA(J)=0.9*NA(J):IF B=1 THEN NA(J)=NA(J)+SMLB*0.4:M=0.01:GOSUB 1
060:GOTO 565
530 IF N=10 THEN IF R=1 THEN NA(J)=NA(J)+SMLR*0.4:M=0.01:GOSUB 1050
565 FOR V=0 TO 1:FOR W=0 TO 11:TE(V,W)=(INT((TE(V,W)+0.05)*10))/10
570 X=TE(V,W):IF X<0 THEN 580
575 IF X<=0.1 THEN TE(V,W)=0
576 GOTO 585
580 TE(V,W)=-1000
585 NEXT W:NEXT V:RETURN
610 IF Z=67 THEN M1$="0":RETURN
611 IF Z=66 THEN M1$="1":RETURN
612 IF Z=71 THEN M1$="2":RETURN
613 IF Z=83 THEN M1$="3":RETURN
614 IF Z=65 THEN M1$="4":RETURN
615 IF Z=80 THEN M1$="5":RETURN
616 IF Z=78 THEN M1$="6":RETURN
617 IF Z=86 THEN M1$="7":RETURN
```

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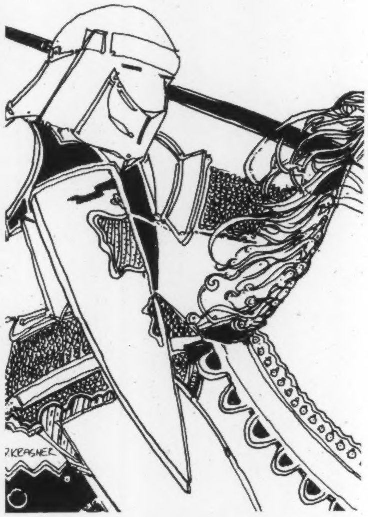
Medieval Combat, continued...

```
618 M1$="9":RETURN
620 IF W<4 THEN GOSUB F:L=W*6:? NUMBER$(L+1,L+6);" ";ARMY$(1,8);"?";:RETURN
621 IF W>3 AND W<8 THEN GOSUB F:L=(W-4)*6:? NUMBER$(L+1,L+6);" ";ARMY$(9,16);"?"
;:RETURN
622 IF W>7 AND W<12 THEN GOSUB F:L=(W-8)*6:? NUMBER$(L+1,L+6);" ";ARMY$(17,24);"
?";:RETURN
625 IF VAL(M1$)=X THEN GOSUB E:? "You're already there!";:GOSUB 1285:GOSUB G:RET
URN
630 GOSUB E:? "Can't move there! Please try again.";:GOSUB 1285:GOSUB G:RETURN
650 FOR V=0 TO 1:FOR W=0 TO 11:TE(V,W)=-1000:NEXT W:NEXT V
655 FOR W=0 TO 11:IF RA(4,W)=J THEN TE(0,W)=RA(1,W)
665 IF BA(4,W)=J THEN TE(1,W)=BA(1,W)
667 NEXT W:RETURN
680 POKE 77,0:FOR T=1 TO 600:NEXT T
681 GOSUB E:? BLK$;:GOSUB F:? BLK$;:RETURN
685 POKE 77,0:FOR T=0 TO 40:NEXT T:RETURN
700 TESR=0:TESB=0:RES=0:R=0:B=0:N=0
705 IF RD<>1 THEN 730
710 FOR W=0 TO 11
711 IF TE(0,W)>0 THEN 713
712 NEXT W:GOTO 730
713 IF BTL THEN 720
714 IF W<4 THEN M=0.4:GOSUB 1100:GOTO 717
715 IF W<8 THEN M=0.8:GOSUB 1100:GOTO 717
716 M=0.8:GOSUB 1100
717 NEXT W:GOTO 730
720 IF W<4 THEN M=0.9:GOSUB 1100:GOTO 725
721 IF W<8 THEN M=0.7:GOSUB 1100:GOTO 725
722 M=0.5:GOSUB 1100
725 NEXT W
730 IF BL<>1 THEN 755
735 FOR W=0 TO 11
736 IF TE(1,W)>0 THEN 738
737 NEXT W:GOTO 755
738 IF BTL THEN 745
739 IF W<4 THEN M=0.4:GOSUB 1110:GOTO 742
740 IF W<8 THEN M=0.8:GOSUB 1110:GOTO 742
741 M=0.8:GOSUB 1110
742 NEXT W:GOTO 755
745 IF W<4 THEN M=0.9:GOSUB 1110:GOTO 750
746 IF W<8 THEN M=0.7:GOSUB 1110:GOTO 750
747 M=0.5:GOSUB 1110
750 NEXT W
755 IF RD AND BL THEN 775
760 IF RD AND NT THEN 770
762 IF BL=0 THEN RETURN
765 RES=TESB/NA(J):IF RES>(1/1.2) AND RES<1.2 THEN B=1:BL=0:N=1:RETURN
766 IF TESB>NA(J) THEN B=10:N=1:NT=0:RETURN
767 RES=NA(J)/TESB:B=1:BL=0:N=10:RETURN
770 RES=TESR/NA(J):IF RES>(1/1.2) AND RES<1.2 THEN R=1:RD=0:N=1:RETURN
771 IF TESR>NA(J) THEN R=10:N=1:NT=0:RETURN
772 RES=NA(J)/TESR:R=1:RD=0:N=10:RETURN
775 RES=TESR/TESB:IF RES>(1/1.2) AND RES<1.2 THEN R=1:RD=0:B=1:BL=0:RETURN
780 IF RES>1 THEN R=10:B=1:BL=0:RETURN
785 RES=TESB/TESR:R=1:RD=0:B=10:RETURN
800 C=1:IF KD(0,J)=1 THEN RETURN
805 FOR W=0 TO 11:IF TE(0,W)<0.15 THEN 815
810 GOSUB 1190:V=RA(5,W):X1=KS(0,V):X2=KS(1,V):Y1=KS(2,V):Y2=KS(3,V):GOSUB 3400:
RA(4,W)=RA(5,W):GOSUB 3300
815 NEXT W:RETURN
820 C=2:IF KD(0,J)=2 THEN RETURN
825 FOR W=0 TO 11:IF TE(1,W)<0.15 THEN 835
830 GOSUB 1195:V=BA(5,W):X1=KS(0,V):X2=KS(1,V):Y1=KS(2,V):Y2=KS(3,V):GOSUB 3400:
BA(4,W)=BA(5,W):GOSUB 3300
835 NEXT W:RETURN
850 FOR W=0 TO 11
851 IF TE(0,W)>=0 THEN RA(1,W)=TE(0,W):IF RA(1,W)=0 THEN GOSUB 1190:FOR X=2 TO 3
:RA(X,W)=0:RA(X+2,W)=9:NEXT X
855 IF TE(1,W)>=0 THEN BA(1,W)=TE(1,W):IF BA(1,W)=0 THEN GOSUB 1195:FOR X=2 TO 3
:BA(X,W)=0:BA(X+2,W)=9:NEXT X
860 NEXT W:GOSUB 3500:RETURN
870 GOSUB 3610+J:L=LT:KD$=HLD$:RETURN
880 IF N=0 THEN 900
882 IF N=10 THEN GOSUB 3610+J:LW=LT:WN$=HLD$:GOTO 900
891 GOSUB 3610+J:LL=LT:LS$=HLD$
900 IF R=10 THEN WN$=NMR$:LW=LR
901 IF R=1 THEN LS$=NMR$:LL=LR
902 IF B=10 THEN WN$=NMB$:LW=LB
903 IF B=1 THEN LS$=NMB$:LL=LB
904 GOSUB F:? "Sires! Battle results!";:GOSUB G
905 IF RES<1.2 THEN GOSUB E:? "Heavy losses on both sides!";:GOSUB F:? "Both sid
es are retreating!";
906 IF RES<1.2 THEN GOSUB G:GOTO 940
910 IF RES>=2 THEN 935
915 IF N THEN 925
920 GOSUB E:? WN$(1,LW);" has defeated ";LS$(1,LL);"!";:GOSUB F:? LS$(1,LL);"s a
rmies are retreating!";
921 GOTO 940
925 IF N=10 THEN GOSUB E:? WN$(1,LW);" has withstood the siege!";
926 IF N=10 THEN GOSUB F:? LS$(1,LL);"s armies are retreating!";:GOTO 940
930 IF N=1 THEN GOSUB E:? WN$(1,LW);" has conquered ";LS$(1,LL);"!";
931 IF N=1 THEN GOSUB F:? "Survivors have joined the rebels!";:GOTO 940
```



```
935 GOSUB E:? "Forces of ";LS$(1,LL);" destroyed!";:GOSUB F:? WN$(1,LW);" is vic
torious!";
940 GOSUB G:RETURN
950 FOR W=0 TO 11:IF RA(4,W)=J THEN RA(1,W)=M*RA(1,W):RA(1,W)=(INT((RA(1,W)+0.05
)*10))/10
970 IF BA(4,W)=J THEN BA(1,W)=M*BA(1,W):BA(1,W)=(INT((BA(1,W)+0.05)*10))/10
980 NEXT W:GOSUB 3500:RETURN
1000 RBA(J)=0.5*RBA(J):GOSUB F:? "Rebels retreat after a bloody battle!";:GOSUB
1285:GOSUB G:RETURN
1010 RBA(J)=0:GOSUB F:? "Rebels destroyed! A glorious victory!";:GOSUB 1285:GOSU
B G:RETURN
1020 RBA(J)=0.8*RBA(J):GOSUB E:? "Rebels inflict heavy losses";:GOSUB F:? "then
fade away!";
1021 GOSUB 1285:GOSUB G:RETURN
1030 RBA(J)=0.9*RBA(J):GOSUB E:? "Rebels destroy opposition!";:GOSUB F:? "A mili
tary disaster!";
1031 GOSUB 1285:GOSUB G:RETURN
1050 FOR W=0 TO 11:TE(0,W)=M*TE(0,W):NEXT W:RETURN
1060 FOR W=0 TO 11:TE(1,W)=M*TE(1,W):NEXT W:RETURN
1070 FOR W=0 TO 11:TE(V,W)=TE(V,W)+ADD:NEXT W:RETURN
1090 FOR W=0 TO 11:IF TE(V,W)>0 THEN TE(V,W)=M*TE(V,W):TE(V,W)=(INT((TE(V,W)+0.0
5)*10))/10
1091 NEXT W:RETURN
1100 TESR=TESR+M*TE(0,W):RETURN
1110 TESB=TESB+M*TE(1,W):RETURN
1120 FOR W=0 TO 11:IF TE(V,W)>0 THEN SMW=SMW+1
1123 NEXT W:RETURN
1130 FOR W=0 TO 11:IF TE(1,W)>0 THEN SMLB=SMLB+TE(1,W)
1131 NEXT W:RETURN
1140 FOR W=0 TO 11:IF TE(0,W)>0 THEN SMLR=SMLR+TE(0,W)
1141 NEXT W:RETURN
1150 X1=KS(0,J):X2=KS(1,J):Y1=KS(2,J):Y2=KS(3,J):RETURN
1160 GOSUB E:? "Epidemic of cholera has broken out in";:GOSUB F:? "kingdom of ";
KD$(1,L);"!";:GOSUB G
1161 M=0.85:GOSUB 950:RETURN
1165 GOSUB E:? KD$(1,L);" reports dysentery epidemic!";:GOSUB F:? "Many deaths r
eported!";:GOSUB G
1166 M=0.8:GOSUB 950:RETURN
1170 GOSUB E:? "Mild influenza reported in ";KD$(1,L);"!";:GOSUB F:? "Loses are
minimal!";:GOSUB G
1171 M=0.9:GOSUB 950:RETURN
1175 GOSUB E:? "Severe flooding in ";KD$(1,L);"!";:GOSUB F:? "Heavy losses repor
ted!";:GOSUB G
1176 M=0.8:GOSUB 950:RETURN
1180 GOSUB F:? "Reinforcements reported in ";KD$(1,L);"!";:GOSUB G:M=1.2:GOSUB 9
50:RETURN
1190 COLOR 32:PLOT RA(2,W),RA(3,W):RETURN
1195 COLOR 32:PLOT BA(2,W),BA(3,W):RETURN
1200 IF IKB=J THEN GOSUB E:? NAMEB$:GOSUB G
1201 IF IKR=J THEN GOSUB E:? NAMER$:GOSUB G
1202 GOSUB E:? "Sire! Due to your incompetence,";:GOSUB F:? "your home kingdom h
as been lost!";:GOSUB G
1205 GOSUB E:? "Your subjects are defecting to";:GOSUB F:? "join the opposing fo
rces!";:GOSUB G
1210 FOR W=0 TO 11:IF IKB=J THEN IF RA(4,W)=J THEN RA(1,W)=(INT((1.3*RA(1,W)+0.0
5)*10))/10
1215 IF IKR=J THEN IF BA(4,W)=J THEN BA(1,W)=(INT((1.3*BA(1,W)+0.05)*10))/10
1220 NEXT W:IF IKB=J THEN IKB=9:NMB$="Blue Sire":LB=9
1225 IF IKR=J THEN IKR=9:NMR$="Red Sire":LR=8
1230 RETURN
1250 FOR X=1 TO 30:SOUND 0,FR,10,10:SOUND 1,FR+10,10,10:SOUND 2,FR+20,10,10:FOR
Y=0 TO 2:SOUND Y,0,0,0:NEXT Y
1251 NEXT X:RETURN
1255 FOR X=0 TO 230 STEP 2:SOUND 0,X+10,10,14:SOUND 1,240-X,10,14:SOUND 2,INT(RN
D(0)*250),10,8:NEXT X
1256 FOR X=0 TO 2:SOUND X,0,0,0:NEXT X:RETURN
1260 FOR W=0 TO 7:IF KD(0,W)=2 THEN J=W:PC=2:C=1:GOSUB 3350
1261 IF KD(0,W)=3 THEN J=W:PC=3:C=1:GOSUB 3350
1262 NEXT W:GOSUB 3110
1263 FOR W=0 TO 11:IF BA(1,W)=0 THEN NEXT W:RETURN
1264 COLOR RA(0,W):PLOT BA(2,W),BA(3,W):NEXT W:RETURN
1265 FOR W=0 TO 7:IF KD(0,W)=1 THEN J=W:PC=1:C=2:GOSUB 3350
1266 IF KD(0,W)=3 THEN J=W:PC=3:C=2:GOSUB 3350
1267 NEXT W:GOSUB 3110
1268 FOR W=0 TO 11:IF RA(1,W)=0 THEN NEXT W:RETURN
1269 COLOR BA(0,W):PLOT RA(2,W),RA(3,W):NEXT W:RETURN
1275 FOR T=0 TO 100:NEXT T:FOR T=0 TO 1:FOR X=1 TO 20:FOR Y=1 TO 15:SETCOLOR 4,Y
14:NEXT Y:NEXT X:NEXT T
1276 SETCOLOR 4,0,0:GOSUB E
1277 ? "Sire! You have been proclaimed";:GOSUB F:? "EMPEROR of the UNIVERSE!";:G
OSUB 1285:GOSUB G:RETURN
1280 FOR X=16 TO 0 STEP -1:FOR Y=FR TO 250 STEP 10:SOUND 0,Y,10,X:NEXT Y:NEXT X:
RETURN
1285 A=INT(RND(0)*100)+100:FOR T=0 TO 60:SOUND 0,A,10,14:SOUND 1,A+1,10,14:NEXT
T:SOUND 0,0,0,0
1286 SOUND 1,0,0,0:RETURN
1290 FOR W=0 TO 11:IF RA(2,W)>0 THEN GOSUB 1190
1291 IF BA(2,W)>0 THEN GOSUB 1195
1292 NEXT W:RETURN
1740 GOSUB E:? "Sires! I am ready to accept";:GOSUB F:? "your battle commands!";
:GOSUB G
1770 MVR$=MV0$:MVB$=MV0$:GOSUB F:? NAMER$;",COMMAND ME!";:GOSUB 1285:OPEN #3,4,0
,"K:":GOSUB G
```

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CIRCLE 236 ON READER SERVICE CARD

Medieval Combat, continued...

```
1780 FOR W=0 TO 11:IF RA(1,W)=0 THEN NEXT W:GOTO 1850
1785 GOSUB 620:POKE 764,255
1790 COLOR RA(0,W):PLOT RA(2,W),RA(3,W):GOSUB 685:IF PEEK(764)<>255 THEN GET #3,
Z:GOSUB 610:GOTO 1820
1800 GOSUB 1190:GOSUB 685:GOTO 1790
1820 X=RA(4,W):FOR Y=0 TO 5:L=1+X*6+Y:IF VAL(EN$(L,L))=VAL(M1$) THEN POP :GOTO 1
840
1830 NEXT Y:GOSUB 625:W=W-1:NEXT W:GOTO 1850
1840 MVR$(W+1,W+1)=M1$:NEXT W
1850 GOSUB 681:GOSUB F:? NAMEB$;",COMMAND ME!";:GOSUB 1285:GOSUB G
1860 FOR W=0 TO 11:IF BA(1,W)=0 THEN NEXT W:GOTO 1925
1865 GOSUB 620:POKE 764,255
1870 COLOR BA(0,W):PLOT BA(2,W),BA(3,W):GOSUB 685:IF PEEK(764)<>255 THEN GET #3,
Z:GOSUB 610:GOTO 1900
1880 GOSUB 1195:GOSUB 685:GOTO 1870
1900 X=BA(4,W):FOR Y=0 TO 5:L=1+X*6+Y:IF VAL(EN$(L,L))=VAL(M1$) THEN POP :GOTO 1
920
1910 NEXT Y:GOSUB 625:W=W-1:NEXT W:GOTO 1925
1920 MVB$(W+1,W+1)=M1$:NEXT W
1925 SOUND 0,0,0,0:POKE 53768,24:FOR T=0 TO 6 STEP 2:POKE 53761+T,168:NEXT T:POK
E 53760,240:POKE 53764,252
1926 POKE 53762,28:POKE 53766,49
1930 GOSUB 681:CLOSE #3:GOSUB F:? "Peasants report troop movements!";:GOSUB G
1940 FOR W=0 TO 11:J=VAL(MVR$(W+1,W+1))
1945 IF J<8 THEN GOSUB 1190:GOSUB 1150:C=1:GOSUB 3400:RA(5,W)=RA(4,W):RA(4,W)=J:
GOSUB 3300
1950 NEXT W
1960 FOR W=0 TO 11:J=VAL(MVB$(W+1,W+1))
1965 IF J<8 THEN GOSUB 1195:GOSUB 1150:C=2:GOSUB 3400:BA(5,W)=BA(4,W):BA(4,W)=J:
GOSUB 3300
1970 NEXT W:FOR T=0 TO 3:SOUND T,0,0,0:NEXT T
1990 Y=INT(RND(0)*3):GOSUB 275+Y
2000 FOR Z=1 TO 8:J=VAL(J$(Z,Z)):BL=0:RD=0:NT=0:BTL=0
2010 FOR W=0 TO 11:IF RA(4,W)=J THEN RD=1:POP :GOTO 2030
2020 NEXT W
2030 FOR W=0 TO 11:IF BA(4,W)=J THEN BL=1:POP :GOTO 2050
2040 NEXT W
2050 IF RD AND BL THEN BTL=1:GOTO 2090
2060 IF RD=0 AND BL=0 THEN 2200
2070 IF KD(0,J)<>3 THEN 2230
2080 NT=1:BTL=0
2090 GOSUB 650:GOSUB 870:GOSUB F:? "Battle underway in ";KD$(1,L);"!";:FR=75:GOS
UB 1280:GOSUB G
2100 GOSUB 700:GOSUB 880:GOSUB 300:GOSUB 850
2120 IF BTL=0 THEN 2300
2130 IF KD(0,J)<>3 THEN 2300
2135 IF RD=0 AND BL=0 THEN NEXT Z:GOTO 2370
2140 NT=1:BTL=1:GOSUB 650:GOSUB F:? KD$(1,L);"s forces attack the victors!";:FR=
150:GOSUB 1280:GOSUB G
2150 GOSUB 700:GOSUB 880:GOSUB 300:GOSUB 850
2160 IF N=10 THEN NEXT Z:GOTO 2370
2170 IF R=10 THEN C=1:PC=3:GOSUB 3350:GOSUB 3110:NEXT Z:GOTO 2370
2180 IF B=10 THEN C=2:PC=3:GOSUB 3350:GOSUB 3110:NEXT Z:GOTO 2370
2200 IF KD(0,J)=3 THEN NEXT Z:GOTO 2370
2210 GOSUB 870:GOSUB E:? "Rebel forces take over ";KD$(1,L);"s";:GOSUB F:? "unde
fended castle!";
2211 FR=10:GOSUB 1250:GOSUB G:IF IKB=J OR IKR=J THEN GOSUB 1200
2220 NA(J)=RBA(J)+1:RBA(J)=0:C=3:PC=KD(0,J):GOSUB 3350:GOSUB 3110:NEXT Z:GOTO 23
70
2230 GOSUB 870:IF BL=1 THEN 2270
2240 IF KD(0,J)=1 THEN NEXT Z:GOTO 2370
2250 GOSUB F:? NMR$(1,LR);" takes over";:GOSUB F:? "undefended ";KD$;"!";:FR=150
:GOSUB 1250:GOSUB G
2255 IF IKB=J THEN GOSUB 1200:GOSUB 3500
2260 C=1:PC=KD(0,J):GOSUB 3350:GOSUB 3110:NEXT Z:GOTO 2370
2270 IF KD(0,J)=2 THEN NEXT Z:GOTO 2370
2280 GOSUB F:? NMB$(1,LB);" takes over";:GOSUB F:? "undefended ";KD$;"!";:FR=150
:GOSUB 1250:GOSUB G
2285 IF IKR=J THEN GOSUB 1200:GOSUB 3500
2290 C=2:PC=KD(0,J):GOSUB 3350:GOSUB 3110:NEXT Z:GOTO 2370
2300 IF R=10 THEN IF KD(0,J)<>1 THEN C=1:PC=KD(0,J):GOSUB 3350:GOSUB 3110:IF IKB
=J THEN GOSUB 1200:GOSUB 3500
2310 IF B=10 THEN IF KD(0,J)<>2 THEN C=2:PC=KD(0,J):GOSUB 3350:GOSUB 3110:IF IKR
=J THEN GOSUB 1200:GOSUB 3500
2320 IF N=10 THEN IF KD(0,J)<>3 THEN C=3:PC=KD(0,J):GOSUB 3350:GOSUB 3110
2330 NEXT Z
2370 J=INT(RND(0)*8):IF KD(0,J)=3 OR RBA(J)=0 OR IKB=J OR IKR=J THEN 2810
2390 GOSUB 870:GOSUB E:? "Peasants report rebels massing";:GOSUB F:? "in ";KD$;"
!";:FR=10:GOSUB 1250:GOSUB G
2400 GOSUB E:? "My lord! Rebels have begun a hit and";:GOSUB F:? "run attack in
";KD$;"!";:GOSUB G
2410 GOSUB 650:TES=0.05:V=0:IF KD(0,J)=2 THEN V=1
2420 FOR W=0 TO 11:IF TE(V,W)>0 THEN TES=TES+TE(V,W)
2430 NEXT W
2440 IF RBA(J)>TES THEN 2520
2450 RES=TES/RBA(J):IF RES>=1.4 THEN 2500
2460 M=0.85:GOSUB 1090:GOSUB 1000:GOTO 2800
2500 M=0.95:GOSUB 1090:GOSUB 1010:GOTO 2800
2520 RES=RBA(J)/TES:IF RES>=1.4 THEN 2560
2530 M=0.6:GOSUB 1090:GOSUB 1020:GOTO 2800
2560 M=0.01:GOSUB 1090:GOSUB 1030:NA(J)=RBA(J):RBA(J)=0:PC=1+V:C=3:GOSUB 3350:GO
SUB 3110
2800 GOSUB 850
2810 Z=INT(RND(0)*8)+1:IF Z>5 THEN 2870
```

```
2815 J=INT(RND(0)*8):GOSUB 870:FR=10:GOSUB 1250
2820 ON Z GOSUB 1160,1165,1170,1175,1180
2870 CKR=0:CKB=0:TSR=0:TSB=0
2875 FOR W=0 TO 7:IF KD(0,W)=1 THEN CKR=CKR+1:GOTO 2890
2885 IF KD(0,W)=2 THEN CKB=CKB+1
2890 NEXT W:IF CKR=4 AND CKB=4 THEN GOSUB F:? "A STALEMATE?";:GOSUB 1285:GOSUB G
:GOTO 2925
2895 IF CKR<4 THEN 2911
2900 GOSUB E:? "The forces of ";NMR$(1,LR);" have triumphed!";:GOSUB F:? "Opposi
ng forces are collapsing!";
2905 GOSUB 1255:GOSUB 1260:GOSUB G:GOSUB 1275:GOTO 2950
2911 IF CKB<4 THEN 2925
2912 GOSUB E:? "Complete victory for ";NMB$(1,LB);"!";:GOSUB F:? "Opponents pled
ge fealty to you!";
2915 GOSUB 1255:GOSUB 1265:GOSUB G:GOSUB 1275:GOTO 2950
2925 FOR W=0 TO 11:TSR=TSR+RA(1,W):TSB=TSB+BA(1,W):NEXT W:IF TSR>2 AND TSB>2 THE
N 1740
2930 IF TSR>2 AND TSB<=2 THEN GOSUB E:? NMB$(1,LB);"s forces have been destroyed
!";:GOSUB F
2931 IF TSR>2 AND TSB<=2 THEN ? NMR$(1,LR);" triumphs!";:GOSUB 1255:GOSUB 1260:G
OSUB G:GOSUB 1275:GOTO 2950
2935 IF TSB>2 AND TSR<=2 THEN GOSUB E:? NMR$(1,LR);"s armies have been anihilate
d!";:GOSUB F
2936 IF TSB>2 AND TSR<=2 THEN ? NMB$(1,LB);" is victorious!";:GOSUB 1255:GOSUB 1
265:GOSUB G:GOSUB 1275:GOTO 2950
2940 IF TSR<=2 AND TSB<=2 THEN GOSUB E:? "Both armies decimated!";:GOSUB F
2941 IF TSR<=2 AND TSB<=2 THEN ? "War no longer possible! Peace at last!";:GOSUB
 1255:GOSUB G
2950 GOSUB G:? :? :? :? "Sires! Do you wish to war again";:INPUT PL$:POKE 752,1
2960 IF PL$="N" THEN ? :? :? :? "Peace settles upon the kingdoms!":GOSUB 1285:GO
SUB 1290:GOSUB 3100:GOSUB G:END
2970 IF PL$="Y" THEN ? :? :? :GOSUB E:? "My lords,tension is mounting";:GOSUB F:
? "between your kingdoms!";
2975 IF PL$="Y" THEN GOSUB 1285:GOSUB 1290:GOSUB G:GOTO 240
2980 GOTO 2950
3000 RESTORE 9000:FOR V=0 TO 14:READ W,X,Y,Z:COLOR 43:PLOT W,X:DRAWTO Y,Z:NEXT V
3010 RESTORE 9020:FOR V=0 TO 9:READ W,X,Y,Z:COLOR 10:PLOT W,X:DRAWTO Y,Z:NEXT V:
RETURN
3100 RESTORE 9040:FOR W=0 TO 7:FOR V=0 TO 9:READ Z:KD(V,W)=Z:NEXT V:NEXT W
3110 FOR W=0 TO 7:COLOR KD(1,W):PLOT KD(2,W),KD(3,W):IF KD(4,W)=0 THEN 3115
3111 COLOR KD(4,W):PLOT KD(5,W),KD(6,W):IF KD(7,W)=0 THEN 3115
3112 COLOR KD(7,W):PLOT KD(8,W),KD(9,W)
3115 NEXT W:RETURN
3150 FOR X=0 TO 18 STEP 2:COLOR 154:PLOT X,0:COLOR 186:PLOT X,19:NEXT X
3152 FOR X=1 TO 19 STEP 2:COLOR 186:PLOT X,0:COLOR 154:PLOT X,19:NEXT X
3154 FOR Y=2 TO 18 STEP 2:COLOR 154:PLOT 0,Y:COLOR 186:PLOT 19,Y:NEXT Y
3156 FOR Y=1 TO 17 STEP 2:COLOR 186:PLOT 0,Y:COLOR 154:PLOT 19,Y:NEXT Y
3160 RESTORE 9150:FOR Y=2 TO 0 STEP -1:READ Z:COLOR Z:PLOT 0,Y:NEXT Y:FOR X=1 TO
 4:READ Z:COLOR Z:PLOT X,0:NEXT X
3161 FOR X=7 TO 13:READ Z:COLOR Z:PLOT X,0:NEXT X:FOR X=16 TO 19:READ Z:COLOR Z:
PLOT X,0:NEXT X
3162 FOR Y=1 TO 4:READ Z:COLOR Z:PLOT 19,Y:NEXT Y
3163 RESTORE 9155:FOR Y=8 TO 14:READ Z:COLOR Z:PLOT 19,Y:NEXT Y:FOR X=15 TO 19:R
EAD Z:COLOR Z:PLOT X,19:NEXT X
3164 FOR Y=18 TO 16 STEP -1:READ Z:COLOR Z:PLOT 19,Y:NEXT Y:FOR X=7 TO 12:READ Z
:COLOR Z:PLOT X,19:NEXT X
3165 RESTORE 9160:FOR Y=16 TO 19:READ Z:COLOR Z:PLOT 0,Y:NEXT Y:FOR X=1 TO 4:REA
D Z:COLOR Z:PLOT X,19:NEXT X
3166 FOR Y=8 TO 13:READ Z:COLOR Z:PLOT 0,Y:NEXT Y:RETURN
3200 RESTORE 9200:FOR W=0 TO 7:FOR V=0 TO 3:READ Z:KS(V,W)=Z:NEXT V:NEXT W
3210 FOR V=0 TO 7:NA(V)=2+INT(RND(0)*5):RBA(V)=0:NEXT V
3220 RESTORE 9210:FOR W=0 TO 11:READ Z:RA(0,W)=Z:NEXT W
3230 RESTORE 9220:FOR W=0 TO 11:READ Z:BA(0,W)=Z:NEXT W
3240 FOR W=0 TO 11:RA(1,W)=2:BA(1,W)=2:NEXT W
3250 J=INT(RND(0)*3)+1:RBA(J)=NA(J):NA(J)=0:PC=3:C=1:GOSUB 3350:X1=KS(0,J):X2=KS
(1,J):Y1=KS(2,J)
3251 Y2=KS(3,J):IKR=J:FOR W=0 TO 11:RA(4,W)=J:RA(5,W)=J:NEXT W:GOSUB 3600:GOSUB
3110
3252 FOR W=0 TO 11:GOSUB 3400:GOSUB 3300:NEXT W:T=J
3255 J=5+INT(RND(0)*3):IF T+3=J THEN 3255
3260 RBA(J)=NA(J):NA(J)=0:PC=3:C=2:GOSUB 3350:X1=KS(0,J):X2=KS(1,J):Y1=KS(2,J)
3261 Y2=KS(3,J):IKB=J:FOR W=0 TO 11:BA(4,W)=J:BA(5,W)=J:NEXT W:GOSUB 3600:GOSUB
3110
3262 FOR W=0 TO 11:GOSUB 3400:GOSUB 3300:NEXT W:RETURN
3300 IF C=1 THEN IF RA(1,W)=0 THEN 3320
3301 IF C=1 THEN COLOR RA(0,W):PLOT RA(2,W),RA(3,W):GOTO 3320
3310 IF C=2 THEN IF BA(1,W)=0 THEN 3320
3311 IF C=2 THEN COLOR BA(0,W):PLOT BA(2,W),BA(3,W)
3320 RETURN
3350 ON C GOSUB 3370,3380,3390
3360 KD(0,J)=C:RETURN
3370 IF PC=3 THEN KD(1,J)=KD(1,J)+96:IF KD(4,J) THEN KD(4,J)=KD(4,J)+96:IF KD(7,
J) THEN KD(7,J)=KD(7,J)+96
3372 IF PC=3 THEN RETURN
3374 IF PC=2 THEN KD(1,J)=KD(1,J)-32:IF KD(4,J) THEN KD(4,J)=KD(4,J)-32:IF KD(7,
J) THEN KD(7,J)=KD(7,J)-32
3376 IF PC=2 THEN RETURN
3378 IF PC=1 THEN RETURN
3380 IF PC=3 THEN KD(1,J)=KD(1,J)+128:IF KD(4,J) THEN KD(4,J)=KD(4,J)+128:IF KD(
7,J) THEN KD(7,J)=KD(7,J)+128
3382 IF PC=3 THEN RETURN
3384 IF PC=1 THEN KD(1,J)=KD(1,J)+32:IF KD(4,J) THEN KD(4,J)=KD(4,J)+32:IF KD(7,
J) THEN KD(7,J)=KD(7,J)+32
```

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CIRCLE 133 ON READER SERVICE CARD

Medieval Combat, continued...

```
3386 IF PC=1 THEN RETURN
3388 IF PC=2 THEN RETURN
3390 IF PC=1 THEN KD(1,J)=KD(1,J)-96:IF KD(4,J) THEN KD(4,J)=KD(4,J)-96:IF KD(7,
J) THEN KD(7,J)=KD(7,J)-96
3392 IF PC=1 THEN RETURN
3394 IF PC=2 THEN KD(1,J)=KD(1,J)-128:IF KD(4,J)<>0 THEN KD(4,J)=KD(4,J)-128:IF
KD(7,J) THEN KD(7,J)=KD(7,J)-128
3396 IF PC=2 THEN RETURN
3398 IF PC=3 THEN RETURN
3400 FOR X=X1 TO X2:FOR Y=Y1 TO Y2:LOCATE X,Y,V:IF V<>32 THEN 3440
3410 IF C=1 THEN RA(2,W)=X:RA(3,W)=Y:POP :POP :GOTO 3490
3420 IF C=2 THEN BA(2,W)=X:BA(3,W)=Y:POP :POP :GOTO 3490
3440 NEXT Y:NEXT X
3490 RETURN
3500 POKE 752,0:POKE 656,0:POKE 657,1:? "C";:FOR X=0 TO 3:GOSUB 3540:NEXT X:? "A
";:FOR X=4 TO 7:GOSUB 3540:NEXT X
3510 ? "I";:FOR X=8 TO 11:GOSUB 3540:NEXT X
3520 POKE 656,1:POKE 657,1:? "C";:FOR X=0 TO 3:GOSUB 3570:NEXT X:? "A";:FOR X=4
TO 7:GOSUB 3570:NEXT X
3530 ? "I";:FOR X=8 TO 11:GOSUB 3570:NEXT X:POKE 752,1:? " ";:RETURN
3540 S=10*RA(1,X):IF S<10 THEN 3560
3550 ? S;" ";:RETURN
3560 ? " ";S;" ";:RETURN
3570 S=10*BA(1,X):IF S<10 THEN 3590
3580 ? S;" ";:RETURN
3590 ? " ";S;" ";:RETURN
3600 GOSUB 3610+J:IF C=1 THEN NMR$=HLD$:LR=LT:RETURN
3605 IF C=2 THEN NMB$=HLD$:LB=LT:RETURN
3610 HLD$="CAMELOT":LT=7:RETURN
3611 HLD$="BURGANDY":LT=8:RETURN
3612 HLD$="GALESIA":LT=7:RETURN
3613 HLD$="SAXONY":LT=6:RETURN
3614 HLD$="ARAGON":LT=6:RETURN
3615 HLD$="PICARDY":LT=7:RETURN
3616 HLD$="NORMANDY":LT=8:RETURN
3617 HLD$="VALHALLA":LT=8:RETURN
9000 DATA 7,2,7,9,8,4,8,7,9,5,9,7,7,10,7,11,13,7,17,7,12,9,12,10,13,8,13,10,14,1
0,14,11
9010 DATA 14,12,15,12,3,12,4,12,1,13,4,13,1,14,5,14,1,15,2,15,8,15,8,17,9,15,9,1
7
9020 DATA 13,3,13,4,6,2,6,7,13,5,14,5,15,4,15,6,5,5,5,7,1,7,3,7,14,14,15,14,15,1
5,18,15,8,14,12,14,10,15,10,17
9040 DATA 3,39,2,3,35,3,3,0,0,0
9050 DATA 3,35,17,2,0,0,0,0,0,0
9060 DATA 3,33,12,6,40,13,6,34,14,6
9070 DATA 3,36,2,10,38,3,10,36,4,10
9080 DATA 3,34,9,11,37,10,11,34,11,11
9090 DATA 3,33,17,10,0,0,0,0,0,0
9100 DATA 3,36,2,17,0,0,0,0,0,0
9110 DATA 3,37,14,17,40,15,17,37,16,17
9150 DATA 227,193,237,197,236,207,244,199,225,204,229,211,233,193,226,213,242,19
9,225,206,228,217
9155 DATA 208,233,195,225,210,228,217,246,193,236,200,225,204,236,193,225,210,22
5,199,239,206
9160 DATA 238,207,242,205,225,206,228,217,243,193,248,207,238,217
9200 DATA 1,5,1,6,14,18,1,6,8,12,1,6,1,6,8,12
9201 DATA 8,13,8,13,15,18,8,14,1,7,15,18,11,18,15,18
9210 DATA 156,157,158,159,140,141,142,143,252,253,254,255
9220 DATA 188,189,190,191,172,173,174,175,220,221,222,223
32000 GRAPHICS 1:POKE 559,0:START=(PEEK(106)-6)*256:POKE 756,START/256:POKE 752,
1
32010 SHI=INT(START/256):SLO=START-SHI*256:POKE 203,SLO:POKE 204,SHI
32020 DIM CHAR$(28):CHAR$="h)M)`N1MKHPyfLfN%NIbPm`":Z=USR(ADR(CHAR$)):RESTORE 32
100
32030 READ X:IF X=-1 THEN 32050
32040 FOR Y=0 TO 7:READ Z:POKE X+Y+START,Z:NEXT Y:GOTO 32030
32050 DLST=PEEK(560)+256*PEEK(561):POKE DLST+24,134:RESTORE 32125:FOR X=0 TO 15:
READ Y
32060 POKE 1536+X,Y:NEXT X:POKE 512,0:POKE 513,6:POKE 54286,192:RETURN
32100 DATA 8,165,231,231,231,255,219,255,231
32101 DATA 16,66,231,165,231,165,231,255,255
32102 DATA 24,161,162,228,232,240,227,227,227
32103 DATA 32,5,69,231,231,167,255,255,231
32104 DATA 40,24,60,126,66,126,219,255,255
32105 DATA 48,0,0,0,36,36,36,255,255
32106 DATA 56,153,153,153,153,153,255,153,255
32107 DATA 64,0,0,0,0,165,255,219,255
32108 DATA 80,0,24,60,126,60,24,24,24
32109 DATA 88,4,14,63,115,0,48,120,252
32110 DATA 96,128,44,68,254,76,44,20,22
32111 DATA 104,1,44,68,254,76,44,20,22
32112 DATA 112,0,44,68,254,76,44,20,150
32113 DATA 120,0,44,68,254,76,45,20,22
32114 DATA 208,255,255,255,255,255,255,255,255
32115 DATA 224,128,152,8,40,106,28,20,20
32116 DATA 232,1,25,8,40,106,28,20,20
32117 DATA 240,0,24,8,40,106,28,148,148
32118 DATA 248,0,24,8,40,106,28,21,21
32119 DATA 480,0,50,36,120,112,116,80,80
32120 DATA 488,0,50,36,120,112,113,80,80
32121 DATA 496,0,50,36,120,112,112,80,84
32122 DATA 504,0,50,36,120,112,112,80,81
32123 DATA -1
32125 DATA 72,169,5,133,204,198,204,208,252,169,224,141,9,212,104,64
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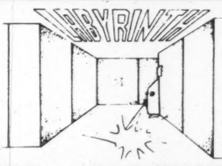

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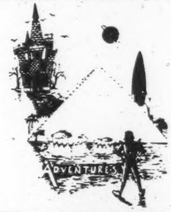

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Authors note to players — I wrote this one with a concordance in hand. It is very accurate — and a lot of fun. It was nice to wander around the ship instead of watching it on T.V.

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A Joystick For The Color Computer

Ian Hodgson

One of the strong points of the TRS-80 Color Computer is its game playing ability. For many games, joysticks are essential. They come in two basic varieties: the proportional control type contains a pair of potentiometers, one for vertical and the other for horizontal control. This type of joystick normally works with an analog-to-digital converter and yields values from 1 to 63 (for the 6-bit converter on the Color Computer) with 31 at the center. The switch type of joystick contains four momentary contact switches and gives values of up, down, left, right and center, but no in-between states. These joysticks normally have a spring return to center.

The joysticks sold by Radio Shack for the Color Computer are of the proportional control type, and do not automatically return to center. They are well suited to controlling objects on the screen where the position of the object is controlled by the position of the joystick. Many arcade type games do not behave this way, however. Instead, the player moves or changes direction whenever the joystick is off center and stops moving or changing direction when center is reached. For such games the response is much better when a switch-type joystick is used. The most common of the switch-type joysticks are those sold by Atari and Commodore. Here you will learn how to connect these to your Color Computer.

You will be amazed by the control you have over your favorite arcade games.

Theory

The Atari joystick contains five small "oilcan" type switches for left, right, up, down and fire. (Note: if your joystick contains coil spring switches, you have an ancient model and I suggest you buy one of the newer ones.) All five have one side connected to a common ground return; the other sides are used to connect one of five input lines to ground. The original wiring is shown in Figure 1.

The Radio Shack joystick interface requires quite a different arrangement, which allows you to vary a voltage from about 0.25v to 4.75v on each of two input lines. This means that you must isolate the common connection from several of the switches. This is done by cutting two of the traces on the joystick printed circuit, and setting the voltages to the correct values with four resistors (the voltage is already supplied by the Color Computer). The final circuit wiring is shown in Figure 2.

Ian Hodgson, 296 Malcolm Circle, Dorval, Quebec H9S 1T7.

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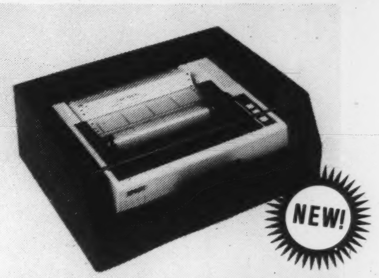

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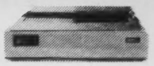

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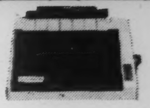

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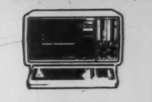

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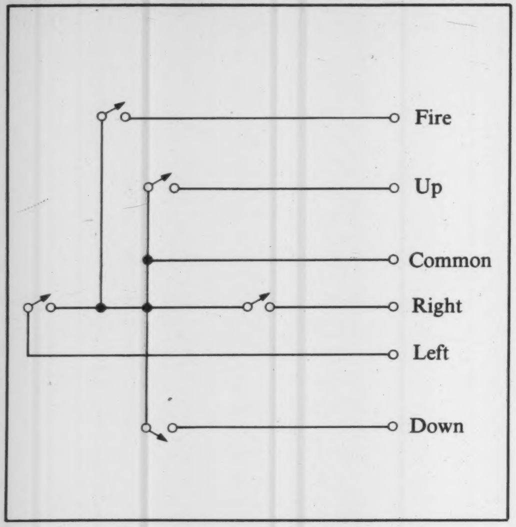


Figure 1. The original wiring of the Atari or Commodore joystick.

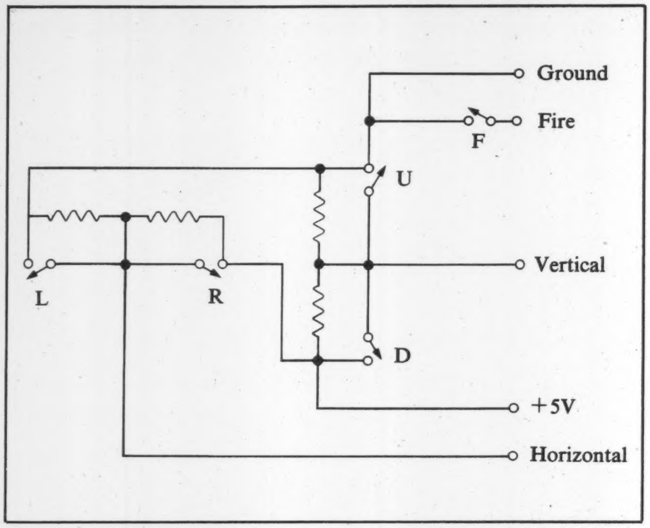


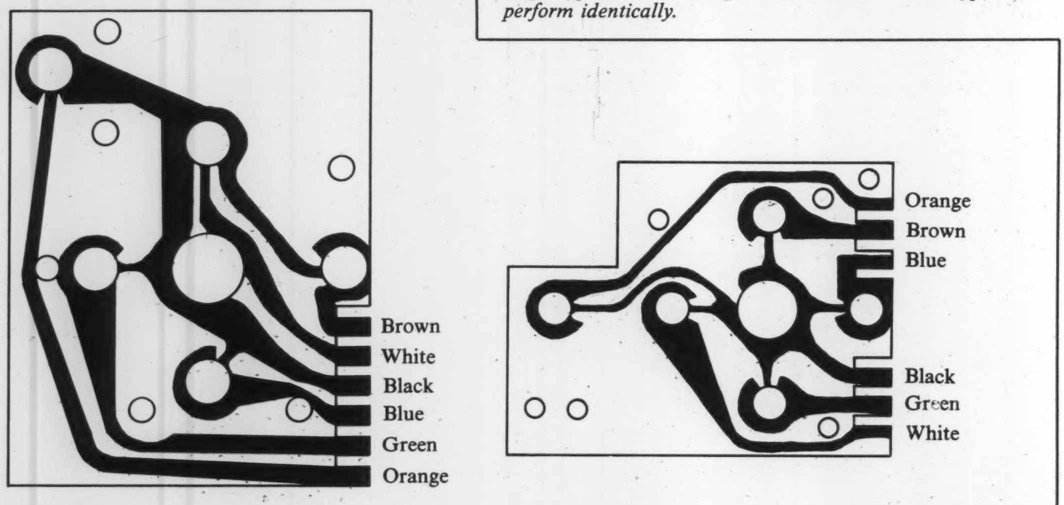
Figure 2. The joystick circuit must be modified as shown to work with the Color Computer. Four resistors and two circuit cuts are required to do this.

Construction

To do the job, you will need: an Atari or Commodore joystick (they appear to be identical), a 5-pin, wide spaced (240 degree) DIN plug to match the joystick connector on the TRS-80; four 51K ohm, ¼ watt resistors; some fine gauge wire (I used wire wrap wire); and a soldering iron, as well as ordinary electronic tools.

To begin, remove the bottom from the Atari joystick. It is held in place by four Philips head screws. Hold the joystick upside down while separating the halves of the case, and be careful not to lose the small spring in the fire button. Inside, you will see a small printed circuit board as shown in Figure 3a. (Since this article was originally written I have bought a second joystick and it is constructed differently in a much smaller case. The operation is identical, though, and its circuit board is shown in Figure 3b.) This board is covered with a transparent plastic tape and has five small circular switches held in place by the tape. *Do not* lift the tape and disturb them, as they must be accurately positioned. You must make some modifications to this board.

Figure 3. The circuit board of the Atari joystick. The wire colors represent the original connections. Figure 3a shows the larger type board, and Figure 3b shows the smaller type. Both perform identically.



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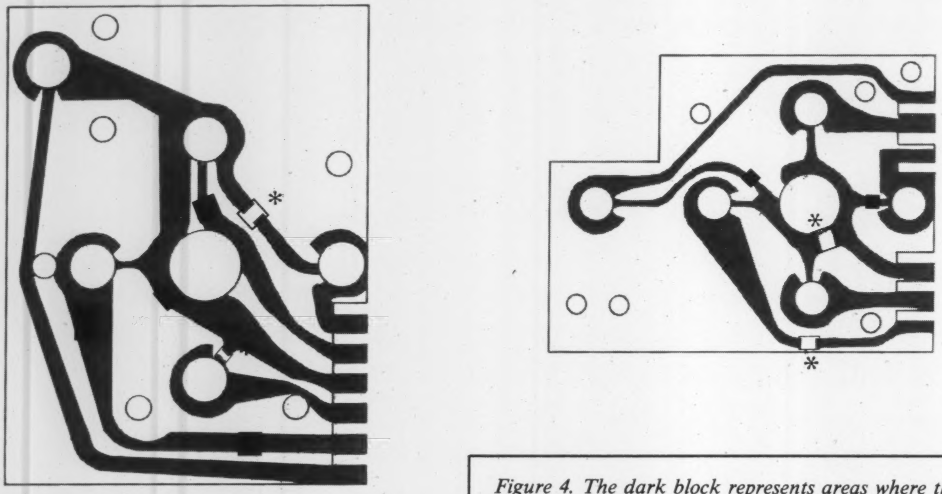


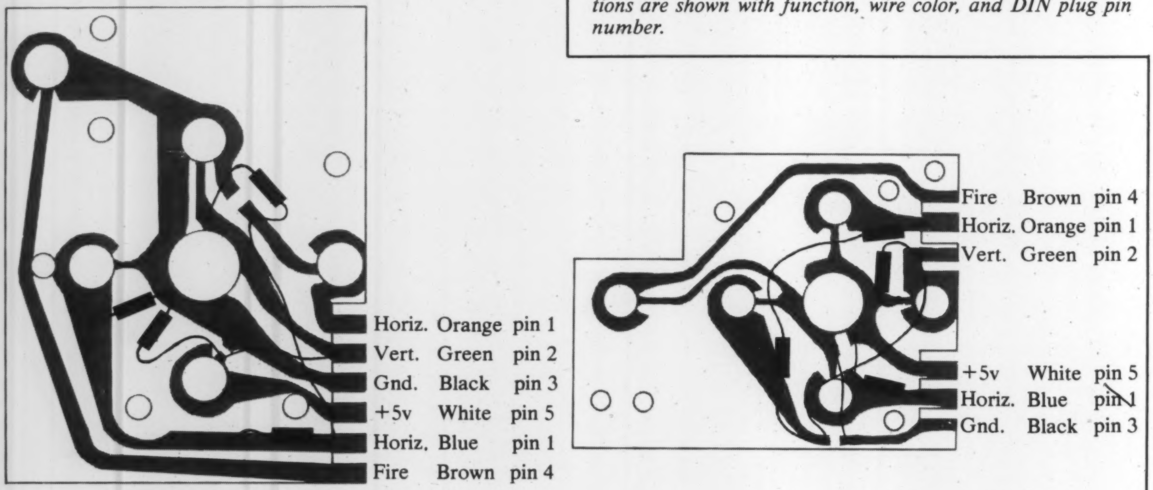
*Figure 4. The dark block represents areas where the insulating tape should be cut off the board as described in the text. Two places marked with open boxes and *'s should also have a cut made in the copper foil.*

Six colored wires are attached to the board, as shown in Figure 3. They may be removed so that the board is easily accessible. Using a small X-acto knife, carefully cut small rectangles out of the tape in the six spots shown in Figure 4a for the older type or Figure 4b for the newer one. The point of the knife may be used to lift the bits of tape off the board.

At the two openings marked with an *, carefully cut through the copper traces on the board. To do this, firmly scribe two lines about 1mm apart, cutting completely through the copper trace. Then, with the point of the knife, pry out the small sliver of copper that has been freed. On this phenolic board material the copper should lift off quite easily. If it does not, you have probably not cut all the way through the trace. Check with a magnifying glass to make sure that there is no connection left at these points.

Install the four 51K ohm resistors (47K should work just as well and may be easier to find) in the positions shown in Figure 5a or 5b. Trim and shape their

Figure 5. Four resistors and two wire jumps must be soldered to the circuit board. Place them as shown, and they should not interfere with any of the hardware. The new wire connections are shown with function, wire color, and DIN plug pin number.


Horiz. Orange pin 1
Vert. Green pin 2
Gnd. Black pin 3
+5v White pin 5
Horiz. Blue pin 1
Fire Brown pin 4
Fire Brown pin 4
Horiz. Orange pin 1
Vert. Green pin 2
+5v White pin 5
Horiz. Blue pin 1
Gnd. Black pin 3

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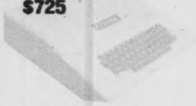

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Joystick, continued...

leads before soldering, and use a small, hot iron and low temperature (63% tin) solder if you can get it. Temporarily replace the covers to make sure that the resistors don't interfere with the support posts; move the resistors if they do. There is nothing like a fast session with *Space Invaders* to break improperly mounted resistors. Install the two wire jumpers also shown in Figure 5. The new circuit diagram is shown in Figure 2.

Now you may replace the board in the holder and reconnect the wires using the color coding shown in Figure 5. Hold the assembly upside down and replace the bottom of the case making sure that no wires are trapped or interfere with the motion of the stick. Disassemble the DIN plug and note that the pins are numbered. If you can't read the numbers, refer to Figure 6. Cut off the DB-9 connector on the end of the Atari cable (if you leave a few inches of wire on it, you may be able to re-use it for something else later). Strip about ½" of insulation off the cable, and about ⅛" off the colored wires. Then solder the wires to the pins as follows:

Pin 1 - orange and blue (twisted together)
Pin 2 - green
Pin 3 - black
Pin 4 - brown
Pin 5 - white

Now you will probably discover that you have forgotten to slide the plug hood over the cable. If so, you will have to undo those nice solder connections and start over. Otherwise, assemble the DIN connector, and the job should be finished.

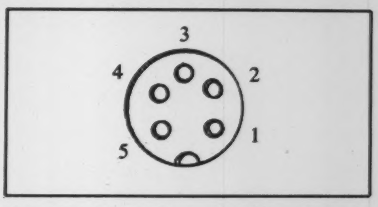
Testing and Operating

Connect the joystick to the right joystick connector, and type in the following program to test it:

```
10 CLS
20 A = JOYSTK(0)
30 B = JOYSTK(1)
40 F = PEEK(65280)
50 PRINT@0,A,B,F
60 GOTO 20
```

When you run this program, your screen should clear and show values of 31, 31 and either 127 or 255. Press the fire button. The 127 should change to a 126 (or the 255 to a 254). Push the stick left. This should change the first 31 to a 0. Push the stick right. This should change the first 31 to a 63. Similarly, up should change the second 31 to a 0 and down should change it to a 63.

Figure 6. The DIN 5-pin plug, viewed from the pin end. On most plugs the pin numbers are clearly marked. Slide the hood over the cable before soldering to the pins.



Congratulations! It works. Now, how do you use it?

Unlike the Radio Shack joysticks, which allow any value from 0 to 63 in both the vertical and horizontal directions, this conversion allows only values of 0, 31, and 63 in each direction. Most games that I have tried work perfectly with this arrangement. If you are writing your own programs, you will have to arrange a timing loop so that the position or speed of objects depends on how long the joystick returns a 0 or 63 rather than on its exact position.

You will be amazed by the control you now have over your favorite arcade games. The spring return to center instantly quadrupled my score on *Gobbler* (a Pac-Man type game). The entire job can be done in less than an hour for only about $12. ☐

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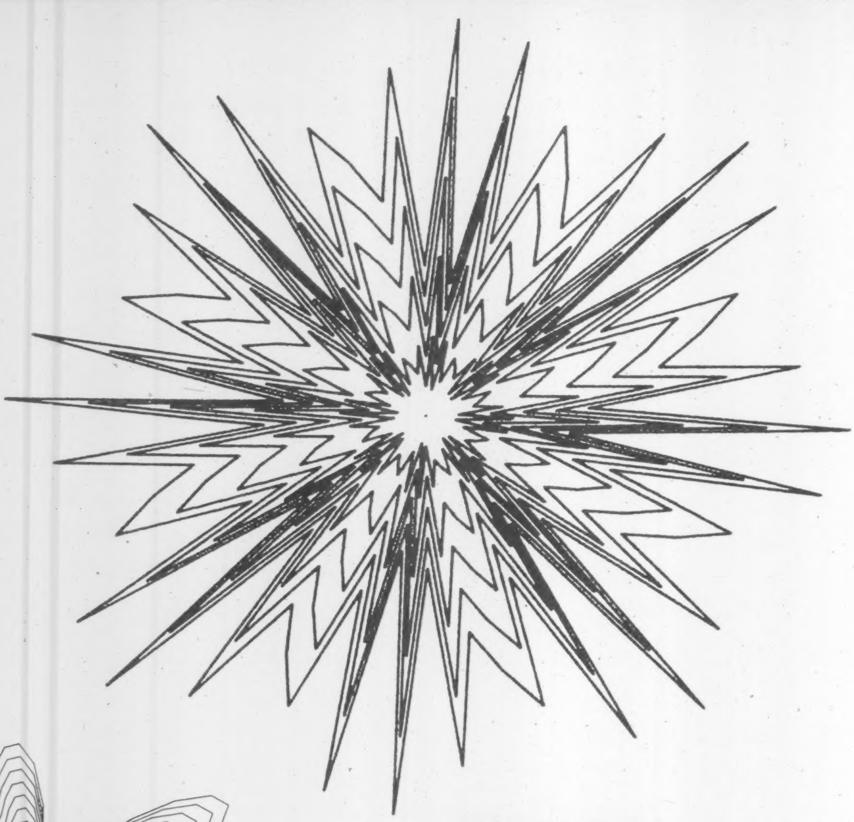
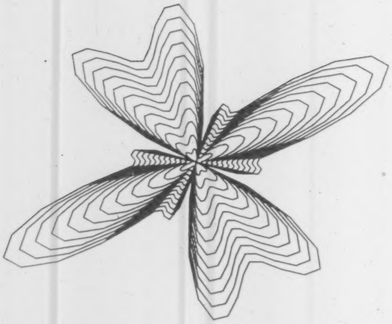




```
80 REM SINE PRODUCT
81 PAGE
82 PRINT "ENTER B"
83 INPUT B
84 PRINT "ENTER C"
85 INPUT C
86 PRINT "ENTER H"
87 INPUT H
88 PRINT "ENTER M; M MUST BE 1 OR 2."
89 INPUT M
90 PRINT "ENTER G"
91 INPUT G
92 PRINT "ENTER K"
93 INPUT K
94 Z1=0
95 PRINT "ENTER L"
96 INPUT L
100 PRINT "ENTER D"
110 INPUT D
120 U=INT(360/G)+10
130 DIM X(U),Y(U)
140 SET DEGREES
150 PRINT "ENTER T1. T1 MUST BE 1 OR 2."
```

Computer Art For The Tektronix 4052

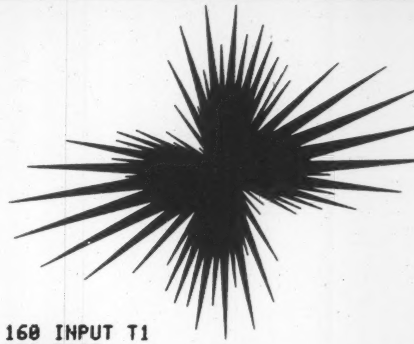
Joe Jacobson

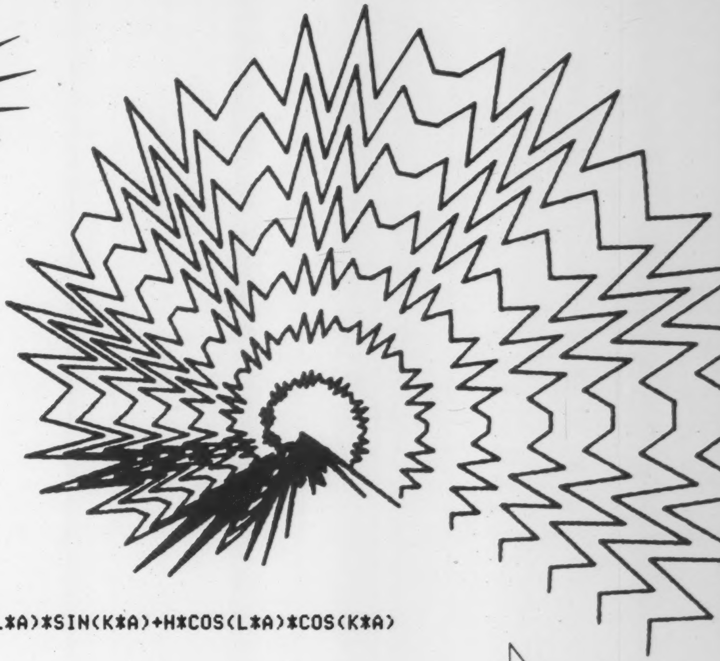
This month I will discuss my Sine Product computer program. This is somewhat similar in structure to the other polar coordinate programs I presented in recent issues of *Creative Computing*; it involves successive angular sweeps with the radius incremented between sweeps. However, a different polar function is used in Sine Product.

The radius is computed as the weighted sum of products of two sinusoids, or as the absolute value of that weighted sum (depending on the value you enter for the parameter M).

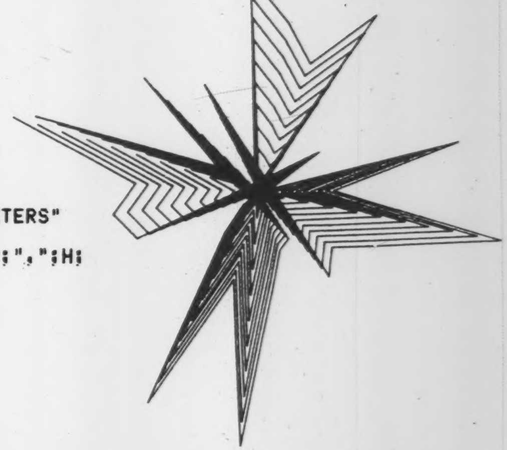
Technically, this program was more difficult to write because it required automatic scaling. The radius values computed can be very large or very small, depending on the input parameter values selected, and it is desirable to have the pattern just fill the screen in all cases. This scaling was accomplished through the use of storage arrays and an algorithm that finds the maximum value of the radius.

Joe Jacobson, 675 E. Street Road, Apt. 1009, Warminster, PA 18974.





```
160 INPUT T1
170 PAGE
180 FOR Q=D TO 360 STEP D
190 V=1
200 FOR A=0 TO 360 STEP G
210 GOSUB 330
220 V=V+1
230 NEXT A
240 GO TO 540
250 FOR Q1=1 TO V-1
260 IF Q1>1 THEN 290
270 MOVE X(Q1),Y(Q1)
280 GO TO 300
290 DRAW X(Q1),Y(Q1)
300 NEXT Q1
310 NEXT Q
320 GO TO 420
330 R=B*SIN(L*A)*COS(K*A)+C*SIN(L*A)*SIN(K*A)+H*COS(L*A)*COS(K*A)
340 R=Q*R
350 IF M=1 THEN 370
360 R=ABS(R)
370 IF Q>D THEN 390
380 Z1=R MAX Z1
390 X(V)=R*COS(A)
400 Y(V)=R*SIN(A)
410 RETURN
420 IF T1=2 THEN 530
430 WINDOW 0,130,0,100
440 VIEWPORT 0,130,0,100
450 MOVE 0,10
460 PRINT "                          SINE PRODUCT PROGRAM PARAMETERS"
470 MOVE 0,5
480 PRINT "                     (B,C,H,M,G,K,L,D) = (";B;",";C;",";H;
490 PRINT ",";M;",";G;",";K;",";L;",";D;")"
500 INPUT J$
510 T1=2
520 GO TO 170
530 END
540 IF T1=2 THEN 570
550 VIEWPORT 22,108,14,100
560 GO TO 580
570 VIEWPORT 15,115,0,100
580 Z2=Z1+Z1/1000
590 Z2=Z2*(360/D)
600 WINDOW -Z2,Z2,-Z2,Z2
610 GO TO 250
```



The parameters B, C, and H, which are requested in user prompts, are the weighting coefficients for the products of sinusoids. K and L are angular frequency coefficients in the arguments of the sinusoids. D is the radius increment added between successive angular sweeps. G is the angular increment within a sweep. Enter M=2 if you want the radius to be an absolute value; enter M=1 otherwise.

As with the programs previously described, setting T1=1 yields a design plot with the input parameter values listed at the bottom. Then you clear the screen and hit RETURN and a "clean" plot (without the parameter list) appears. If you don't want the parameter list at all, set T1=2.

Table 1 lists ranges of input parameters that I have found to give good results. Some values outside these intervals may also work well. Note that B, C, H, G, K, L, and D can be decimal fractions (i.e., not only integers) and some of these can even be negative. You should explore the possibilities inherent in this program by trying various combinations of parameter values. ☐

Table 1. Suggested Parameter Values.

Parameter	Range of Values	
	From	To
B	$-\infty$	$+\infty$
C	$-\infty$	$+\infty$
H	$-\infty$	$+\infty$
M*	1	2
G**	5	15
K	6	60
L	6	60
D	30	50
T1*	1	2

*M and T1 must each be either 1 or 2.
**G must be +2.4 or greater.

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COMPUTERS

IBM ANNOUNCES PC XT, PRICE REDUCTIONS

IBM today extended its Personal Computer line with the IBM Personal Computer XT, which provides individuals and businesses with more than nine times the storage capacity previously available.

The base system, which is priced at $4995, features 131,072 characters of user memory, a dual-sided disk drive with a 368,640 character capacity and a fixed disk drive with a capacity of more than 10 million characters. The IBM Personal Computer XT also includes an asynchronous communications adapter to enable the system to communicate with other IBM Personal Computers, larger IBM systems and outside information sources. In addition, there are eight expansion slots, three of which are used for the already installed communications adapter and the floppy and fixed disk drives.

With an optional expansion unit installed, and maximum user memory, the XT can store nearly 22 million characters of information, or the equivalent of 11,000 double-spaced, typewritten pages.

Also announced was the IBM Color Display, which features a 12-1/2" screen capable of displaying 256 characters in 16 colors against one of eight background colors.

Along with the introduction of the XT, IBM announced price reductions for IBM Personal Computer products.

A configuration including System Unit with 64K of user memory, keyboard, 160K disk drive and color graphics monitor adapter will be $2108 at IBM Product Centers. Addition of an IBM graphics printer, printer adapter and printer cable would bring the price to $2908. Formerly, this entire configuration would have cost $3305.

A larger configuration, consisting of a 64K system unit and keyboard, with two 160K disk drives, monochrome display, display/printer adapter and an asynchronous communications adapter, will be $2953. Adding a graphics printer and printer cable would bring the price to $3603.

IBM also introduced a new version of its Disk Operating System, DOS 2.0, which supports the expanded capabilities for both IBM Personal Computers and includes a new version of the Basic Interpreter. The operating system also permits selected IBM application programs to operate on both IBM Personal Computers, as long as the necessary memory, disk storage and other system resources are available.

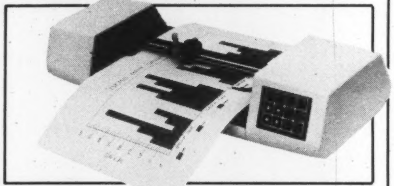
PeachText, a new word processing package for IBM Personal Computers by Peachtree Software, Incorporated, provides a series of Help menus for quick problem solving. The program allows the user to insert new copy in existing text. Simple commands from a single menu enable users to write, correct, change, edit, store, display and print documents.

New versions of IBM Personal Computer business software packages also were announced. Users who already have Version 1.0 of the Peachtree Accounting System may upgrade each program to Version 1.1 through Authorized IBM Personal Computer Dealers. The cost of upgrading each program is $120 at IBM Product Centers.

CIRCLE 405 ON READER SERVICE CARD

TERMINALS & I/O

BAUSCH & LOMB PORTABLE PLOTTER



A new small plotter is available from Houston Instrument. The DMP-40 is a portable single-pen frum plotter featuring pen speeds of up to 4.2 ips, and a format size of up to 11" x 17".

Internal firmware enables the DMP-40 to automatically generate circles, arcs, ellipses and general curves on command. Five different character sets are resident in ROM, which may be presented normally, or as italics, and at 255 possible sizes and 360 different degrees of rotation. Eleven different line types are available, ranging from solid lines, to variations on dotted and dashed lines. The DMP-40 will also clip, window, viewport and scale to size. RS-232-C interfacing is built in, as is the ability to autobaud, at no extra cost. Price is $995.

Bausch & Lomb, 8500 Cameron Road, Austin, TX 78753. (512) 835-0900.

CIRCLE 406 ON READER SERVICE CARD

YOU CAN MAKE A FORTUNE IN MICROS!

THE MICRO COMPUTER BUSINESS WILL GROW FROM $10 TO $100 BILLION IN THE NEXT EIGHT YEARS! ARE YOU READY TO CASH IN?

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These are some of the **100-plus businesses** covered in **PART ONE** of the manual, with the facts on **How to start and run, Start-up Cost (Even** how to operate **on a shoestring**), What **profits to expect, Wholesale prices, Mark-ups, Suppliers, future outlook, case histories** for **each, etc:**

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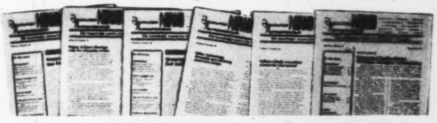

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CIRCLE 147 ON READER SERVICE CARD

DAISY WHEEL PRINTER

Digital Associates has introduced the DP Series 35 and 55 cps daisywheel printers.

Features include in-use noise level of less than 62 dBA; a selection of over 100 font styles in both plastic and metal printwheels; column/status display (DP-55); 90 degree printwheel rotation to permit easy changing; universal power supply; removeable platen; and expandable programmable memory. Compatibility with many computer systems is available. Optional features include cut sheet feeder; tractor feed paper; bottom feed paper slot, and word processing package.

Digital Associates Corp., 1039 E. Main St., Stamford, CT 06902. (800) 243-9054.

CIRCLE 407 ON READER SERVICE CARD

IBM GRAPHICS PRINTER

IBM has announced the IBM Graphics Printer, a new version of the Personal Computer Matrix Printer.

The 80 characters per second, bi-directional printer includes the following features for text and graphics applications.

All points addressable graphics capability with up to 240 dots per inch horizontally, 216 dots vertically; two character sets, one of which is similar to the video display character set, while the other adds international characters enabling users to print French, Spanish, Italian and German; and superscript and subscript capability and an underline module. $595.

IBM Corp., P.O. Box 1328, Boca Raton, FL 33432.

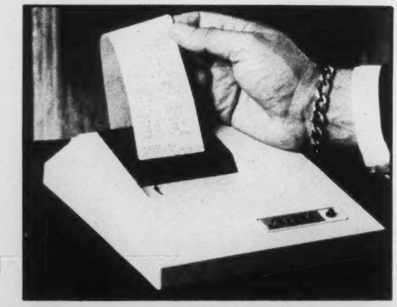
CIRCLE 408 ON READER SERVICE CARD

THERMAL PRINTER

ACI has introduced the MP 2000, a 20-column thermal printer. Features include an integral Bell 103 standard ASCII 300 baud FSK modem for communications over any dial-up phone line and unattended automatic answering on the first or fourth ring which allows incoming messages to be printed at 30 characters per second, 24 hours a day. The FCC registered printer plugs into any standard RJ11 telephone jack and does not require special installation.

Advanced Communication, Inc., 462 Oakmead Pky., Sunnyvale, CA 94086. (408) 773-8585.

CIRCLE 409 ON READER SERVICE CARD



APPLE PRINTERS

A dot matrix and a letter quality printer are now available from Apple Computer, Inc.

The Apple Dot Matrix Printer, which uses a parallel interface, has a printhead life of over 100 million characters. It offers high-resolution graphics output (7 x 9 dot matrix, 144 x 160 dots per square inch) and a bi-directional print speed of 120 characters per second. It permits multiple-pitch and proportional spacing, and will mix fonts during a single pass. The Dot Matrix Printer utilizes pin-addressable graphics, and handles cut sheets or tractor-fed paper (roll or fanfold). $695.

The Apple Letter Quality Printer, which uses a serial interface, prints bidirectionally at 40 cps on individual sheets or continuous forms. Its switch-selectable settings include vertical and horizontal

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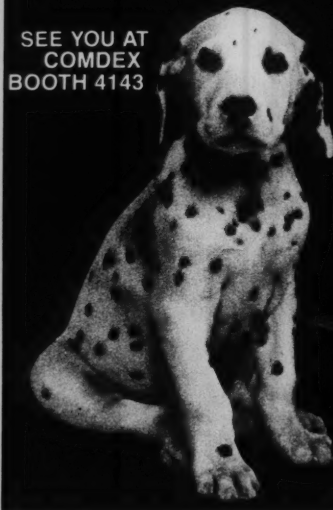

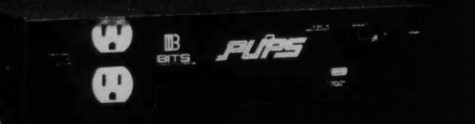

tabs, 6 or 8 lines-per-inch vertical pitch; 10, 12, or 15 characters-per-inch horizontal pitch; and Auto-Line-Feed toggle. A full complement of print wheels, including six foreign language character sets, will be available. $2195.

Apple Computer, Inc. 10260 Bandley Dr., Cupertino, CA 95014. (408) 996-1010.

CIRCLE 410 ON READER SERVICE CARD

COMPOSITE VIDEO COLOR MONITOR

USI International has announced a 14" composite video color monitor.

The monitor eliminates the two-step process of converting the computer's video signal to a form that a television can receive and the subsequent conversion within the television set back to a pure video signal. $399.

USI Computer Products, 71 Park Lane, Brisbane, CA 94005. (415) 468-4900.

CIRCLE 411 ON READER SERVICE CARD

TYPEWRITERS BECOME PRINTERS

Vertical Data Systems Inc. has announced a line of Converters which turn Olivetti and IBM electronic typewriters into computer printers and/or terminals. Printing speeds range from 175 to 230 words per minute.

Converters are available for either Centronix type parallel or RS-232 serial input. The serial version can send as well as receive data and is available for IBM models 50, 60, and or 75. Both versions are available for Olivetti ET121 or ET221.

The Converter fits inside the typewriter, does not affect normal use and requires no modifications. Serial interfaces have selectable baud rates, hardware or XON, XOFF handshake protocols and a built in self test mode.

Vertical Data Systems Inc., 1215 Meyerside Dr., Unit 2, Mississauga, Ontario, Canada L5T 1H3. (416) 671-1752.

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THE TECH™ SHIRT

The TECH Shirt™ with the CRT design is "The Symbol of High Tech", designed exclusively for the high-tech professional and home computer enthusiast. The TECH Shirt is made of the popular LaCoste knit with a fashion-knit collar and represents the high quality and classic styling that is the standard in fine casual wear.

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New Products, continued...

PERIPHERALS

PRINTER BUFFER FOR IBM PC

von Leivendyke Enterprises has announced ConvertaBuffer, model CBP-64, a 64K byte printer buffer designed to work with the IBM PC and the IBM/Epson dot matrix printer. ConvertaBuffer accepts data at 1000 characters per second; stores up to 27 average pages of data in its built-in memory buffer; and then sends it at the IBM/Epson's slower speed of 80 characters per second.

Additionally, ConvertaBuffer can format pages to skip over perforations, number the pages, insert a standard header (such as the date) at the top of each page, and print multiple copies.

ConvertaBuffer comes with its own power supply, and since it connects to the standard parallel printer adapter, it does not use a card slot inside the PC. $299.

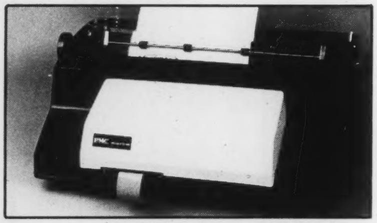
von Leivendyke Enterprises, Silvermine Ave., Norwalk, CT 06850. (203) 846-4973.

CIRCLE 413 ON READER SERVICE CARD

TYPEWRITER TURNED INTO PRINTER

Electric Typing Fingers (ETF-80) is a peripheral which turns an IBM Selectric or equivalent typewriter into a printer.

The ETF-80 offers the following features: compatibility with IBM Selectric or similar typewriters, no need for additional software required, interface cables available for Radio Shack TRS-80, Personal Micro Computers PMC-80/81 and Apple II, IBM Personal Computer adapter available and computer access to all standard typewriter functions. $595.



Personal Micro Computers, Inc., 475 Ellis Street, Mt. View, CA 94043. (415) 962-0220.

CIRCLE 414 ON READER SERVICE CARD

COMPUTER CAMERA

Micron Technology, Inc. has announced the MicronEye, which adds a visual function to a home computer or an inexpensive eye for industrial robotics. Other applications include image storage, signature analysis, games, and scanning for security of home or property.

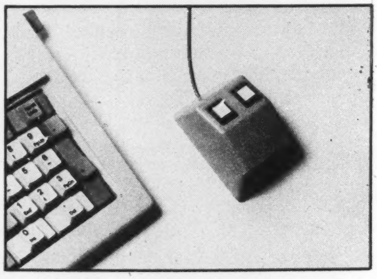
The major component in the camera is the Micron IS32 OpticRAM, which is a light sensitive 64K dynamic RAM in a clear package. The MicronEye connects to the Apple II, IBM PC, TRS-80 Color Computer, Commodore 64 or Timex Sinclair. Included with the camera are the 16mm C-mount lens, tripod, 6' telephone cord (camera to computer), serial interface card, floppy disk with basic software routines, and an instruction manual. $475.

Micron Technology, Inc., 2805 East Columbia Rd., Boise, ID 83706. (208) 383-4000.

CIRCLE 415 ON READER SERVICE CARD

MOUSE FOR MICRO COMPUTERS

Micromouse, designed and priced for microcomputers, has been introduced by the 3G Company. The mouse acts as a pointing device. Roughly the size of a bar of soap and with two pushbutton switches on top, when it is moved on a table top, a small cursor is moved on the computer screen. The pushbutton switches are used to initiate a computer action at the identified screen location. The mouse has word processing and graphics applications. $180.



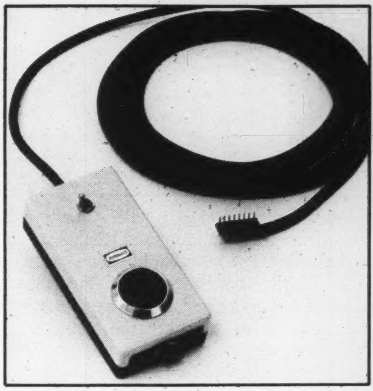
3G Company, Inc., Rt. 3, Box 28A, Gaston, OR 97119. (503) 357-9889.

CIRCLE 416 ON READER SERVICE CARD

LIGHT METER FOR APPLE

A plug-in light meter with accompanying software is being offered by Centronic, Inc. Called "Light Meter II," this hand-size device may be used in a variety of applications including laboratory photometric measurements; home, office or physical plant lighting control; photographic light measurements; solar energy management; and other environmental controls.

The Centronic Light Meter II plugs into any Apple microcomputer and measures light levels up to 6 feet away. The software, which comes on a DOS 3.3 disk, may operate either as a stand-alone light



measurement program or as a subroutine package incorporated into existing application programs. The software can display light levels in footcandles, lumens, or photos. $69.95. Muirhead, Inc., 1101 Bristol Road, Mountainside, NJ 07092. (201) 233-7200.

CIRCLE 417 ON READER SERVICE CARD

TEXT-TO-SPEECH SYNTHESIZER

Micromint, Inc. has introduced the Microvox, a second generation text-to-speech synthesizer.

It can annunciate data transmitted at high baud rates over telephone lines or serve as an unlimited vocabulary audio interface for telephone transaction applications. Features include 64 digitally programmable levels of inflection, a 6K text-to-phoneme algorithm, 750 character buffer, RS-232C parallel connector, music and sound effects capability, and adjustable baud rate.

Attached to a terminal keyboard, Microvox can function as a typewriter for the blind or as a communicator for the vocally impaired. Every ASCII character is recognized (including punctuation) as it is typed and can be echoed automatically. $295.

The Micromint, Inc., 917 Midway, Woodmere, NY 11598. (516) 374-6793.

CIRCLE 418 ON READER SERVICE CARD

PRINT SPOOLING FOR IBM PC

Persyst Inc. has announced Wait-Less Printing, a software print spooler for the IBM Personal Computer.

Wait-Less supports both parallel and serial printers and user-selectable buffer sizes from 2K to 62 Bytes. Buffer size may be automatically assigned through the execution of AUTOEXEC.BAT when the system is initially loaded. $49.95.

Personal Systems Technology, 22957 La Cadena, Laguna Hills, CA 92653. (714) 859-8871.

CIRCLE 419 ON READER SERVICE CARD

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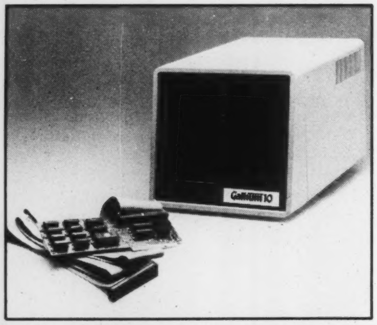
The complete single drive system with 250K unformatted storage, is $375. The dual drive system, which includes two drives, an Apple disk controller and features 500K of unformatted storage, is $850.

Interface, Inc., 20932 Cantara St., Canoga Park, CA 91304. (213) 341-7914.

CIRCLE 420 ON READER SERVICE CARD

WINCHESTER DRIVE FOR APPLE II

XitenSystems has announced Gallium 10, The Ten Meg Plus Winchester for Apple II computers. The Winchester disk subsystem offers an unformatted capacity of 14.4 megabytes and formatted capacity of 11.3 megabytes. Each controller is capable of driving up to four Winchester disk drives for a total formatted capacity of 45 megabytes.



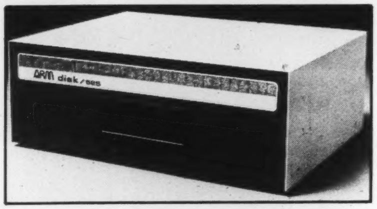
The Gallium 10 is compatible with DOS 3.3, Pascal and CP/M.

XitenSystems, 16815 Hawthorne Blvd., Lawndale, CA 90260. (213) 370-3966 or (800) 421-1947.

CIRCLE 421 ON READER SERVICE CARD

HARD DISK FOR TRS-80

Owners of the Radio Shack TRS-80 Models II and III, and other personal and small business computers can expand storage capacities and cut data accessing times by as much as 80% with Automated Resource Management's ARMdisk/525 Winchester disk subsystem.

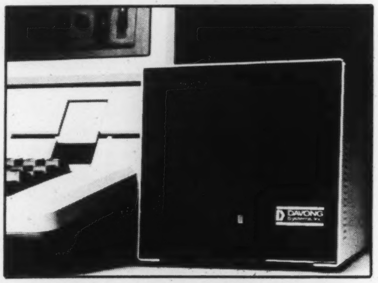


It offers 30 megabytes of formatted hard disk storage and allows up to 4 hosts of equal design to share the same unit. The ARMdisk/525 is supported by TRS-DOS compatible operating systems (HSDS for TRS-80 Model II and LDOS for TRS-80 III). Price is $3395 for the 7-1/2 megabyte system. $3995 for the 15 megabyte system, and $6695 for the 30 megabyte system.

Automated Resource Management, 3613 West MacArthur Blvd., Santa Ana, CA 92704. (714) 850-9792.

CIRCLE 422 ON READER SERVICE CARD

HARD DISK FOR APPLE III



Davong Systems has introduced three hard disk expansion systems for the Apple III, the DSI-A306 with 5Mb formatted (6Mb unformatted), the DSI-A312 with 10Mb formatted (12Mb unformatted), and the DSI-A319 with 15Mb formatted (19Mb unformatted).

All Davong hard disk systems include support for up to four hard disks and back-up for files larger than a floppy disk.

They are compatible with all standard Apple III software: Prices begin at $1995.

Davong Systems, Inc. 1061 Terra Bella Ave., Mountain View, CA 94043. (415) 965-7130.

CIRCLE 423 ON READER SERVICE CARD

GRAPHICS

80-GRAFIX BOARD

The 80-Grafix board gives any configuration of a TRS-80 Model III computer an effective resolution of 512 x 192 (256 x

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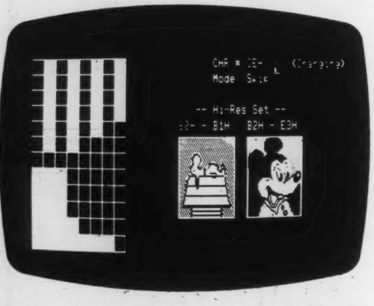
New Products, continued...

192 in the 32 character mode) through the use of 128 programmable characters. These characters are each made up of a 8 x 12 matrix of individually controlled dots. Once programmed, in Basic or machine language, the characters can be easily and rapidly displayed with a PRINT or POKE statement. Software which uses the normal graphics is not affected since the high resolution graphics are disabled whenever the reset button is pressed. In the high resolution mode, which is enabled by a Basic or Assembly language OUT statement, the new graphics characters are given the values 128 to 255.



The board is supported with over 20 programs/files. In addition to many example programs, included are the utility programs Create, Gethr, and Hires83. Hires83, for example, allows you to edit an entire character set one character at a time on an enlarged grid using the arrow keys to draw characters.

The 80-Grafix programmable character generator gives you the ability to make accurace representations of objects that can be easily and quickly moved around, the ability to experiment with graphics, and 100% compatibility with previously written software. Installation requires clipping on six micro-clips, cutting two traces, and removing three integrated circuits from sockets. $169.95.

Micro-Labs Inc., 902 Pinecrest, Richardson, TX 75080. (214) 235-0915.

CIRCLE 424 ON READER SERVICE CARD

MISCELLANEOUS

RS-232C CABLES AND ADAPTORS FOR TRS-80

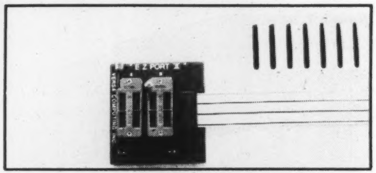
Radio Shack offers TRS-80 computer users eight RS-232 cables and adapters used to connect computers together to transfer information, or to connect peripherals.

RS-232C cables are offered in four lengths: 10 feet (26-1490) for $29.95; 25 feet (26-1491) for $39.95; 50 feet (26-1492) for $54.95; and 100 feet (26-1493) for $89.95. An 8-inch flat cable extender (26-1497) for $17.95 allows the use of longer cables with the TRS-80 Model III desktop microcomputer, which requires flat RS-232C cable.

Two RS-232C cables (male-terminated at both ends) can be connected using a new female-to-female RS-232C adapter (26-1495) for $29.95. The null modem (26-1496) for $29.95 lets two RS-232C-equipped computers communicate without additional equipment. A 5-foot, 4-pin to RS-232 cable (26-1494) for $19.95 connects the TRS-80 Color Computer to Network III.

Tandy Corporation/Radio Shack, 1800 One Tandy Center, Fort Worth, TX 76102. (817) 390-3300.

EZ PORT-II FOR APPLE



Versa Computing, Inc. announces EZ Port-II, a twin switched zero insertion force (ZIF) socketed extension and cable designed to extend the Apple computer game I/O Port. EZ Port-II is a two socket version of EZ Port-I which extends the I/O games port outside of the computer. $34.95.

Versa Computing, Inc., 3541 Old Conejo Rd., Suite 104, Newbury Park, CA 91320. (805) 498-1956.

CIRCLE 426 ON READER SERVICE CARD

SOFTWARE

TRS-80 PROGRAM LIBRARY

Over the past two years, Gordon Speer has written over 250 Basic programs for the 16K TRS-80 Model I and III, most of which have been published in *H & E Computronics Magazine*. For those who do not wish to type them in, Gordon is now offering these programs individually on tape or disk for the nominal cost of $2 each for 1 to 10 and $1 each for programs over 10.

Gordon also has eight business programs such as inventory, dealer list, health insurance and mail lists at prices ranging from $40 to $495. Send a self-addressed stamped envelope for a complete list.

Gordon Speer, 3304 Woodlawn Road, Sterling, IL 61081.

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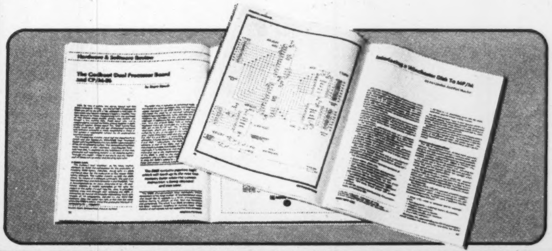

- A comparison of five popular S-100 disk controller cards.
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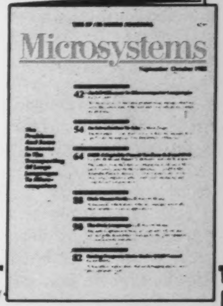

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NEW SUBSCRIBERS ONLY

Controller Corner

Multiple Socket Extensions

This month we will show you how to build multiple socket extensions for Apple computers. These devices provide several convenient functions for the computer user: they bring the game port out of the case to a position beside the keyboard; they permit switching game controllers without interrupting the program currently running; and, with appropriate software, they let you use two standard joysticks at once.

Socket extensions are available commercially, of course, but no single unit has all the features we will describe. Besides, you can construct a home built unit for about half the cost of a commercial one. A multiple socket extension is an excellent first project for learning to work on computer hardware, since the device is simple and easy to construct. The materials are easy to obtain, and only a small multimeter is required for testing the finished unit. What more could you want?

Figures 1 through 5 give you the details of units that were built for the Apple II. We will discuss what might be done to construct multiple socket extensions for other computers later in the article.

Types of Multiple Sockets

There are two types of multiple socket extensions. Those which permit the choice of one of two or more controls will be referred to as *selection units.* Those which permit two standard paddle sets or joysticks to be used at the same time will be called *two-person units.*

We will also describe special features for each type of unit, including click action power switches, isolation diodes

Tom and Kelda Riley

that prevent controls from affecting each other's readings, and zip (zero insertion pressure) sockets. These special features will let you customize the unit to your exact needs.

A Word of Caution

Good practice for working on electronic equipment requires that the power to the unit be turned off before any plug is installed or removed. The power switches on these multiple sockets are intended to allow you to select among controls already plugged into the sockets. Plugging in a paddle when the power switch is off but the computer is turned on violates good practice, although it is preferable to plugging the paddle into a live socket. Remember: turn off the main power supply to your computer before plugging in or unplugging any device from any of these socket extensions.

Tools Required

The construction of a socket extension is primarily a precise and somewhat tedious soldering job. Soldering is the keystone of all hardware skills and one that can only be learned through practice. It is definitely a skill worth mastering.

For this project you need a small pencil soldering iron of about 25 watts and a stand to hold it, a sponge to clean the tip of the iron, desoldering braid to remove solder bridges, and fine resin-core solder. Other tools you should have on hand include a pair of small diagonal cutters, long-nose pliers (for bending fine wires), an X-acto or other small-bladed knife, and wire strippers. The plier-type wire strippers with an adjustment bolt work well but must be adjusted and tested on each new wire size.

The Stacked Plug Unit

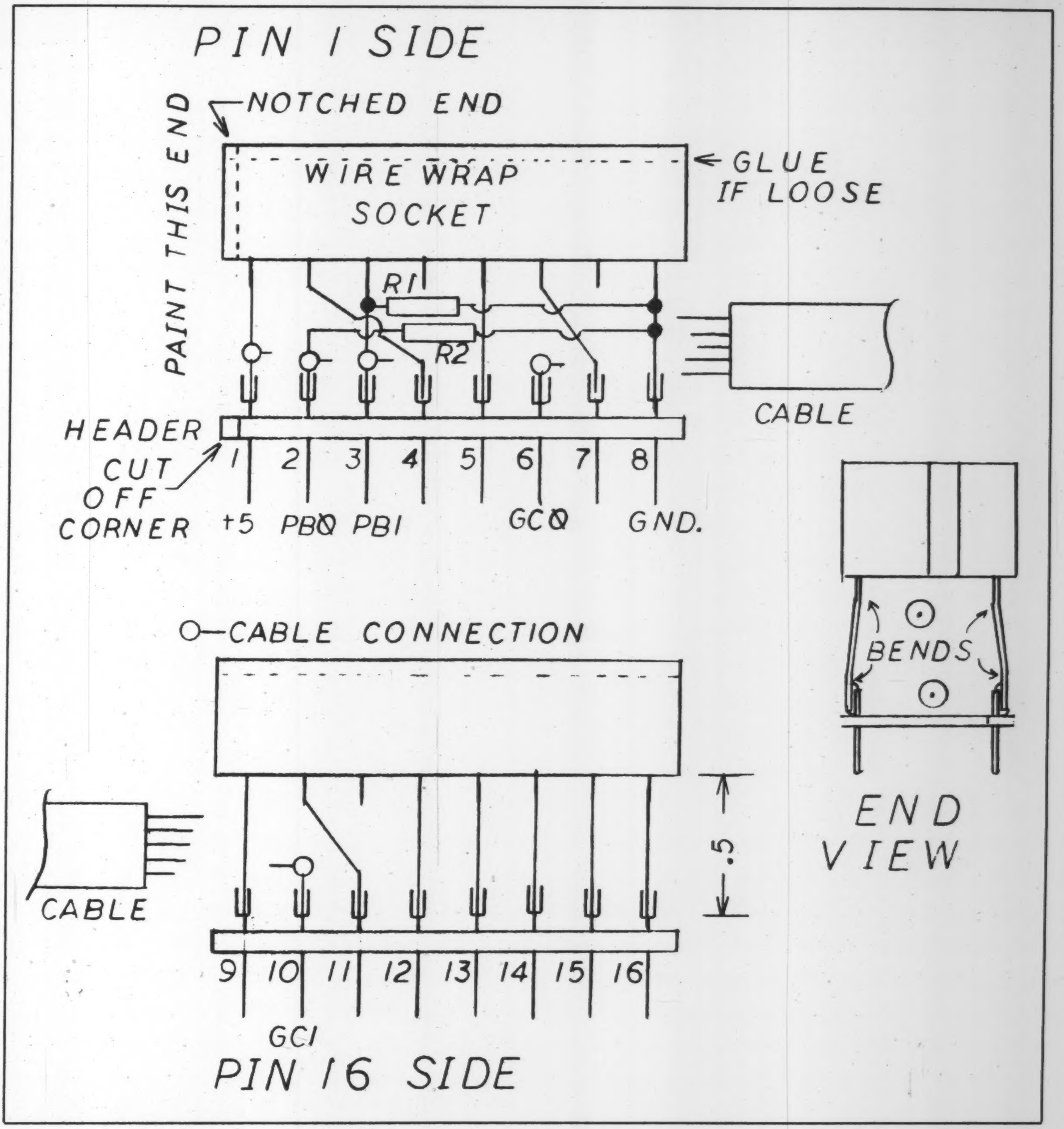
The plugs on Apple paddles and joysticks are easily damaged and may have to be replaced. It is helpful to replace the plug with a stacked plug and socket, thus providing an extra socket of the two-person type. For this replacement you will need a 16-pin wire-wrap socket and a 16-pin dip header. The construction details are given in Figure 1. The socket rides on top of the header, providing not only a new socket but also a handle for the plug.

First trim off the socket pins to an even $\frac{1}{2}$" and bend them out slightly. (You might cut the #2 pin $\frac{1}{16}$" longer.) Then straighten the pin ends as shown in the end view of Figure 1; this allows the wire-wrap pins to slip over the spades of the header. Double check to be sure that the pin 1 end of the header, marked with a cut off corner, is matched to the pin 1 end of the socket, marked with a notch or cut off corner.

Plug the header into another unattached socket so that its pins will not misalign when heated. Solder pins 1, 8, 9, and 16. Then solder pins 3, 5, 12, 13, 14, and 15. Cut off pins 4, 7, and 11 about $\frac{1}{8}$" down from the socket. Using long-nose pliers, bend pin 6 over to fit into spade 7 and bend pin 10 over to reach spade 11.

Now for the tricky part: pin 2 must be bent around behind pin 3 to reach spade 4, but without touching pin 3. If this gives you trouble, try cutting off the #2 pin $\frac{1}{8}$" from the socket and soldering a $\frac{3}{4}$" piece of insulated #22 solid wire between the pin 2 stub and spade 4.

Tom and Kelda Riley, 1002 Lewis Ave., Rockville, MD 20851.


PIN 1 SIDE
NOTCHED END
PAINT THIS END
WIRE WRAP SOCKET
GLUE IF LOOSE
R1
R2
CABLE
HEADER
CUT OFF CORNER
1
2
3
4
5
6
7
8
+5
PB0
PB1
GC0
GND.
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BENDS
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CABLE
.5
9
10
11
12
13
14
15
16
GCI
PIN 16 SIDE

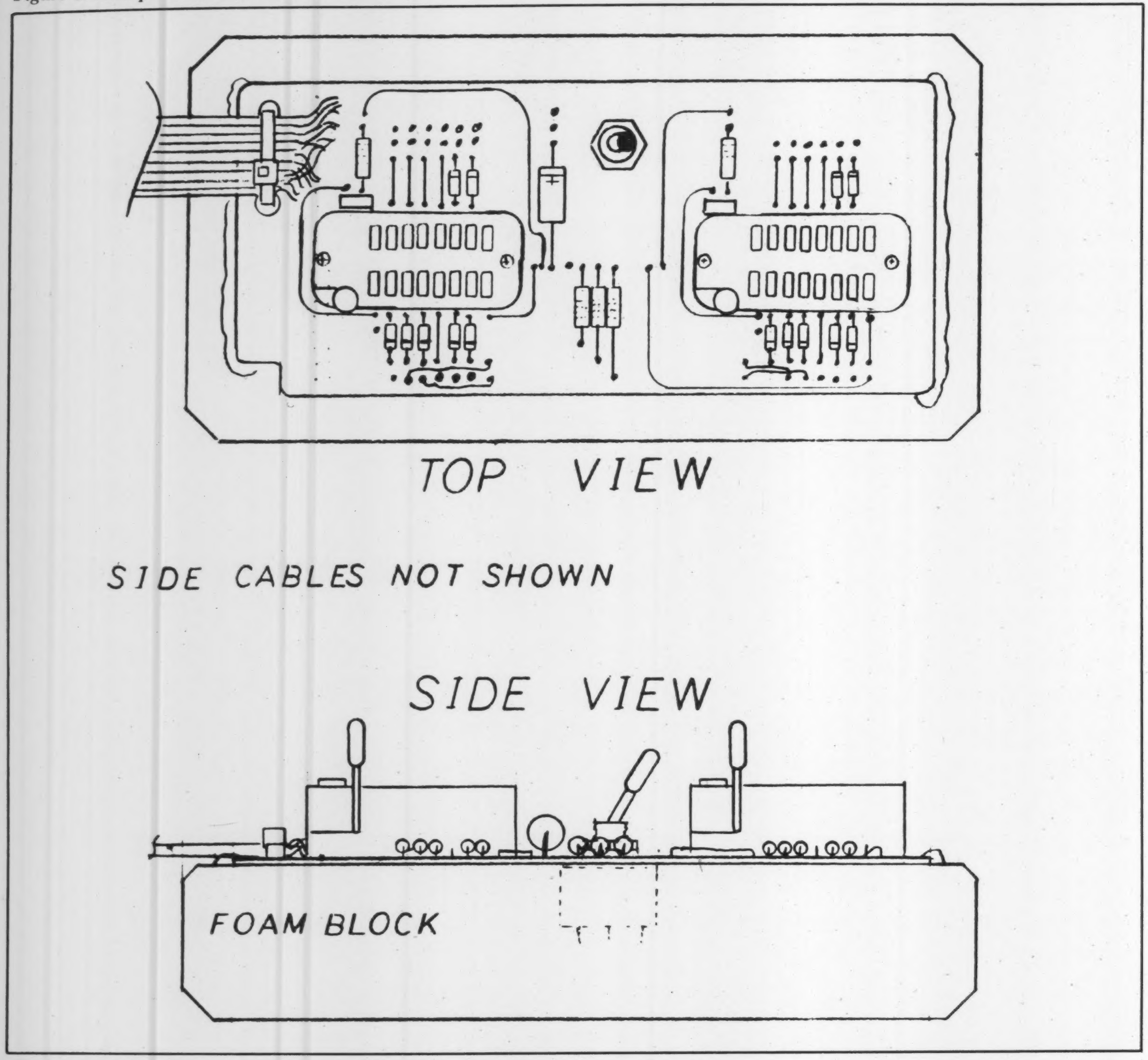
Figure 1. Apple stacked plug.

If the old paddle plug that you are replacing with the stacked unit needs pull-down resistors for its pushbuttons, these can be installed between the socket pins. We used two ¼ watt, 1K ohm, 5% resistors. They share pin 8 for ground; one resistor goes to spade 2 and the other to pin 3. Trim the wires carefully, bend them neatly around the pins, and solder.

The cable should be stripped of its outer cover for ¾" and the wire trimmed. Since the cable normally enters from the pin 8 end, the +5 wire will be longest and the ground wire shortest. Strip the wire back $^{3}/_{16}$", twist the strands, bend them into a small hook, and tin the wire. Your wire stripper must be set so that none of the fine wires are cut. Try several adjustments on a scrap of the same wire until you have it set correctly. One at a time, press each wire into the correct fork or close the hook around the pin shaft, and solder it.

The pin 1 end should be marked with light-colored fingernail polish, model enamel, or white typing correction fluid covered with clear fingernail polish. Sometimes the plastic top of the socket comes loose and must be glued back on

Figure 2. Multiple socket with isolation diodes.



with Super Glue or clear fingernail polish.

Testing the Stacked Plug Unit

If you have a multimeter you should check your wiring for continuity and to insure against shorts. Pin 1 to pin 8 must measure in excess of 50 ohms, and the measurement is usually much greater.

If you have difficulty inserting a plug into the new socket the first time you try it, stick a medium sewing needle into each of the holes in the socket to realign the internal parts with the holes. If you plug the control with this stacked socket into the Apple and then plug a standard set of paddles or a joystick into the new socket, pot 0 of the second joystick acts as pot 2, and its pot 1 acts as pot 3. Similarly, its pushbutton 0 acts as pushbutton 2, but its pushbutton 1 remains pushbutton 1 and is shared with the original joystick. (Apple II has only three pushbuttons.) Incidentally, if you have made the shift key modification for upper/lower case, it will hold pushbutton 2 closed unless the shift key is pressed. This will interfere with the use of the pushbutton on the second joystick plugged into the stacked plug.

You now have all the hardware you need to play two-person competitive games with full joystick control. There is not much software available that makes use of this feature, but you can dream, or write your own.

The Selection Switch Unit

Now let's look at the construction of a multiple socket that can be placed beside the Apple to let you choose between two controls with the flick of a switch. Figure 2 is a sketch of this unit showing the component layout. The terminations of the main cable wires and two side cables are not shown because they would hide the components. These cables will be discussed later.

This multiple socket extension has all the most popular features, including sockets, a click switch, and isolation diodes. If you don't need all of these features and want to leave one or more of them off, the cost of the parts will be reduced.

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- Input Signals: Composite Video Signal, Negative SYNC
  $1.0\,^{+0.5V}_{-0.3V}$ P-P 75 ohm
- CRT Size: 31 cm diag. (12 inch diag.)
- Phosphor: P31 (Green)
- Semiconductors
  IC 1, Transistors 14, Diodes 14
- Video Amp Bandwidth: 15 MHz
- Display Format:
  1920 Characters max. (80 char. × 24 lines)
- Power Input: AC 120V, 60Hz/230V, 50Hz
- Power Consumption: 26W
- Dimensions: 40.0(W) × 28.5(H) × 32.0(D) cm
- Weight: 6.3 kgs. (13.9 lbs.)

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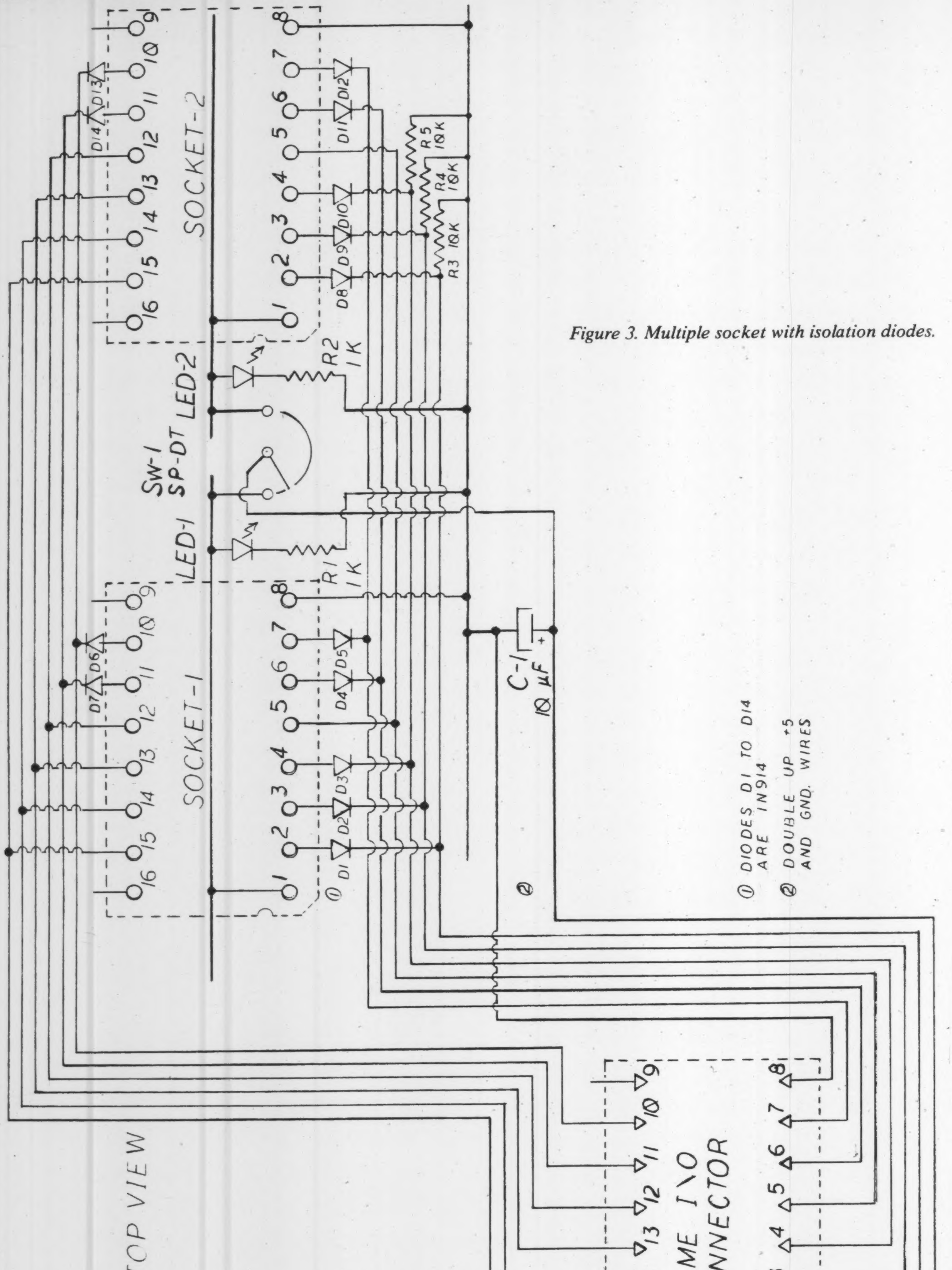
SOCKET-2
SOCKET-1
SW-1
SP-DT
LED-1
LED-2
R1 1K
R2 1K
R3 10K
R4 10K
R5 10K
C-1 10 µF
D1
D2
D3
D4
D5
D6
D7
D8
D9
D10
D11
D12
D13
D14
GAME I/O CONNECTOR
TOP VIEW
① DIODES D1 TO D14 ARE 1N914
② DOUBLE UP +5 AND GND. WIRES

Figure 3. Multiple socket with isolation diodes.

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Controller Corner, continued...

The zip plugs used for this unit cost about $6.20 each (see Parts List), compared to $1.00 for a good standard socket. The zip plugs are larger and have a small lever on the side that locks and unlocks the socket. If you have only one set of paddles and a joystick and want to switch back and forth between them, you probably won't want to pay extra for zip plugs, so buy standard, gold-plated sockets.

We prefer a switch that clicks and makes positive contact to the simple slide switches commonly used on commercial extension sockets. A click switch, however, extends below the circuit board, requiring the foam block shown in Figure 1 for a base.

Figure 3 is the schematic for the selection socket. It is basically very simple: 13 pins of the plug are connected to their counterparts on each socket. The +5 supply (pin 1) is filtered with a capacitor and switched between the two sockets. The only complication is the isolation diodes.

Each socket has seven 1N914 or equivalent general purpose silicon diodes. On the pushbutton lines, they prevent the pull-down resistors or the plugged-in paddles from being in parallel. This would waste +5 current and, if more than four paddles were plugged in at one time, might overload the +5 supply. The use of these diodes necessitates the three 10K pull-down resistors (R3, R4, and R5) on this board.

The four diodes on the game control inputs prevent the pots in the unused controls from affecting the readings of the one in use. These diodes are a must if correction caps are used on any paddle. They may have a slight effect on the paddle readings. Some devices such as the sketch pad (the subject of an upcoming article) and the quad thermometer, will have to have their calibrations checked for when used in sockets with diodes.

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Parts List

Number Required	Description of Part	Suggested Supplier	Total Cost
1	276-154A Experimental Bread Board	Radio Shack	$ 3.70
2	216-3340 ZIP DIP II Socket, 16-pin	Jameco	12.40
2	16-pin W.W. Socket, gold plated	Jameco	1.40
1	16-pin H.P. (Header Plug)	Jameco	.70
2 ft.	Ribbon cable, 20-conductor	Radio Shack	.40
14	1N914 (or 1N4148) diodes	Jameco	1.00
1	Capacitor, 10 uf, 15 volt	Radio Shack	.40
3	Resistor, 10K ohm, 1/4 watt, 5%	Radio Shack	.40
2	Resistor, 1K ohm, 1/4 watt, 5%	Radio Shack	.40
2	Light Emitting Diodes	Radio Shack	1.50
Misc.	Silicone sealant, solder, etc.		1.10
		Total	$26.00

Suppliers:
Jameco Electronics
1355 Shoreway Rd.
Belmont, CA 94002

Circuit Board for the Selection Switch

Figure 4 shows the bottom of half of a Radio Shack printed circuit board (Catalog No. 276-154A Experimental), with modifications to suit this device. The board was cut in half by scoring both sides with an X-acto knife and breaking it over the edge of a table. Each half will make a two-socket unit. Drill a hole in the board to suit the switch you choose and a hole for a wire tie to secure the main cable.

The existing copper lanes must then be cut in 24 places, as shown by the dashed lines in Figure 4. This is done by making two cuts, 1/32" apart, with an X-acto knife and removing the copper sliver between the cuts. Some skill and practice as well as a sharp knife blade are required for this step.

Smooth the edges of the board and the drilled holes with a fine file. Clean the copper lanes by rubbing them vigorously with a pink eraser. This last step, a standard electronics practice, is vital.

The sockets are installed first. Figure 4 shows the pin locations from the bottom: both #1 pins go toward the cable end. The socket pins and all wires should be bent over flat for 1/16" before soldering, since this circuit board does not have the metal-lined holes (often called "plated-through") that a more expensive board would.

The 1N914 diodes can now be installed on pins 2, 3, 4, 6, 7, 10, and 11 of each socket. The end with the black band is the cathode, or positive, terminal and must point away from the socket. Bend the wires over flat, solder them, and cut off the excess. In the 18 places shown in Figure 4, the wires must be bent across an open space to make a bridge from one small copper pad to another. Use the wires cut off of the diodes to make straight wire jumpers the same length as the diodes for pins 5, 12, 13, 14, and 15 on both sockets. This step will make it easier to install the cables.

One of the long copper traces that runs through the socket is used for the ground bus. The negative lead of the capacitor and one end of each pull-down resistor (R3, R4, R5) go to the ground bus. In addition, a wire from pin 8 of each socket must be run to this bus as shown in Figure 2.

The single-pole double-throw switch requires three insulated wires on the underside of the board. The first wire runs from the plus wire of the cap to the center common of the switch, and the other two wires run from pin 1 of each socket to the opposite switch terminal.

The LEDs (light emitting diodes) used for the prototype are small and rectangular, one red, one green. They are slightly more expensive than round LEDs, but that is the only difference. Purchase round ones of any color, if you prefer them. Install the LEDs beside the socket and even with its top. From the positive terminal, run a wire around to pin 1 of each socket. Then install the current-limiting resistors R1 and R2 on a wire run to the ground bus for each. The LED for socket 1 is in an area where there are no copper pads, so loop one wire around the other one before you solder them.

On the pin 1 side (see Figure 4), three bus lanes are used for the pull-down resistors of the pushbuttons. Short insulated jumper wires are needed to run between pins 3 and 4 and these buses on each end, as shown in Figure 2. Both #2 pins are jumped to a bus below the board. As detailed in Figure 5, two of these jumper wires go into holes through which cable wires must also be inserted, so you must wait until the second wire is ready before you solder them both.

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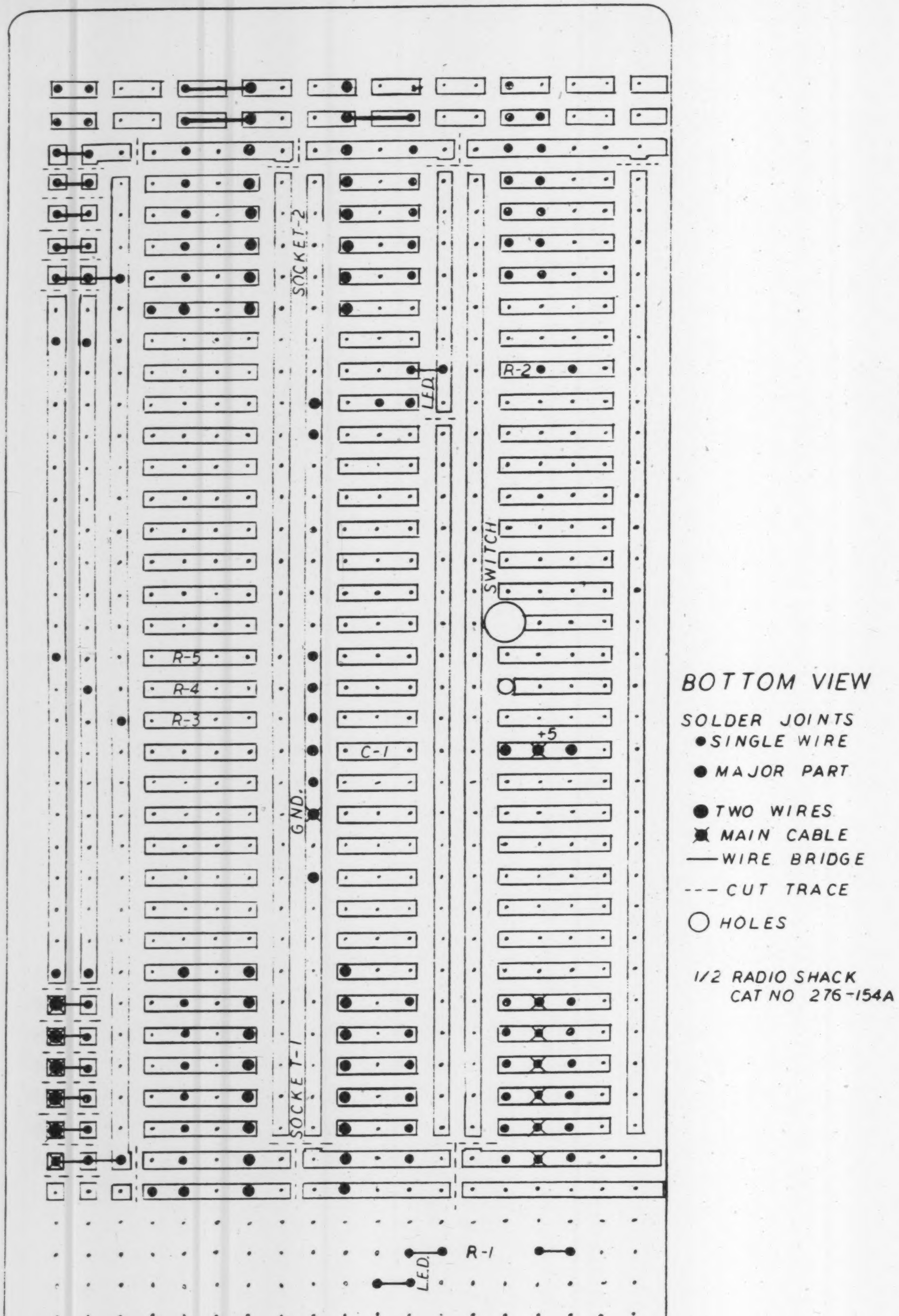
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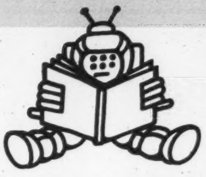
Figure 4. Circuit board for multiple socket with diodes.



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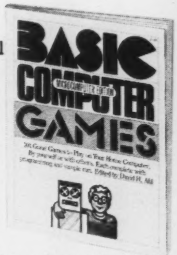

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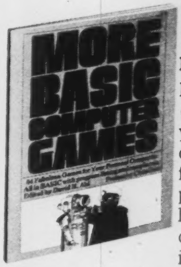

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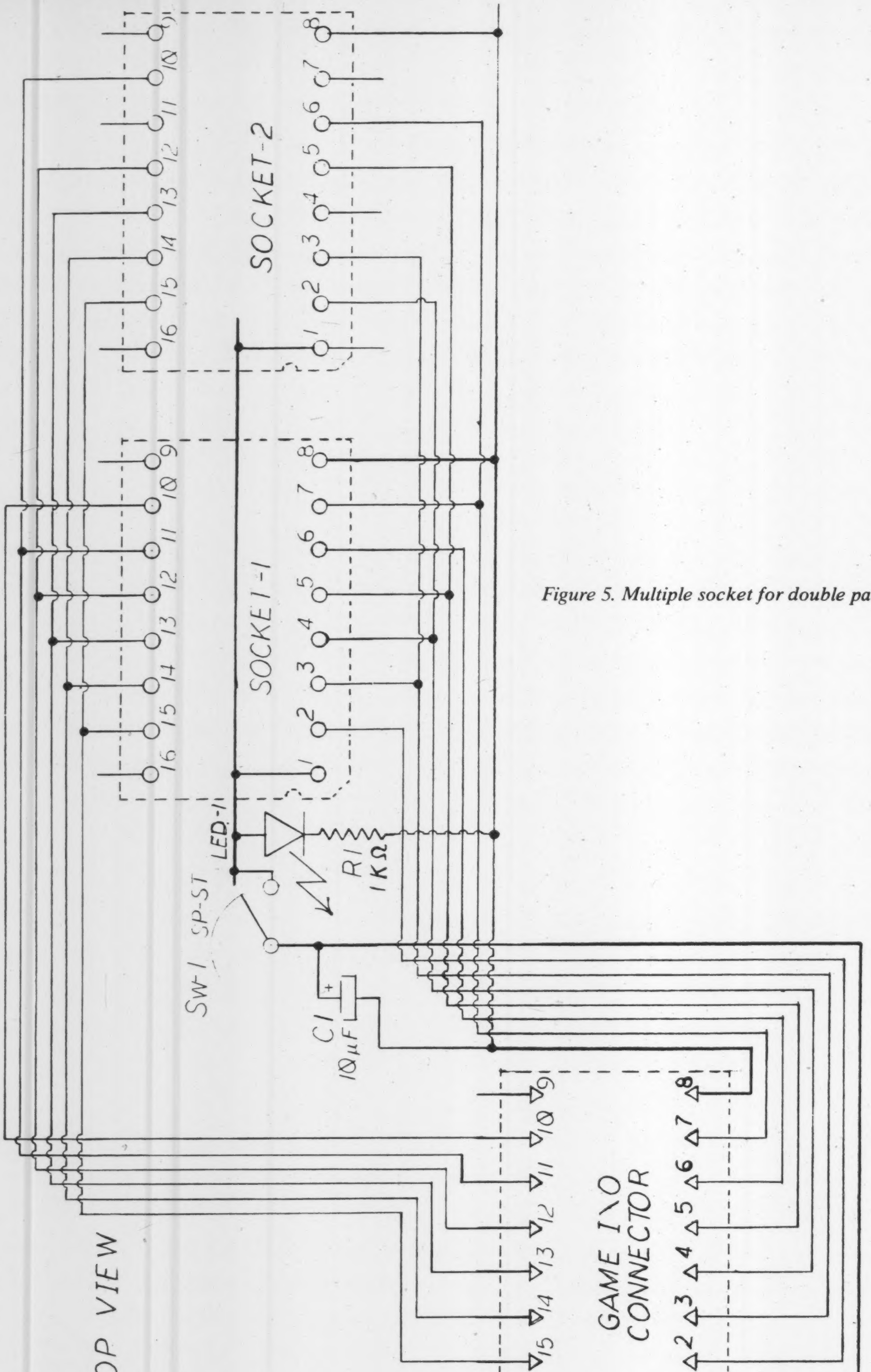

SOCKET-2
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
SOCKET-1
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
LED-1
R1
1KΩ
SW-1 SP-ST
+
C1
10µF
GAME I/O
CONNECTOR
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
TOP VIEW

Figure 5. Multiple socket for double paddle games.

There is a total of five such double-wire holes, and it is somewhat tricky to install and solder the wires. When using a general-purpose circuit board, you will run into a few difficulties like this as a matter of course.

Cables for the Selection Switch

The two side cables noted previously must now be made up and installed. (They were omitted from Figure 2 for the sake of clarity; their locations are shown on Figure 5.) The one on the pin 1 side has three conductors, for pins 5, 6, and 7. The one on the pin 16 side has six conductors, for pins 10, 11, 12, 13, 14, and 15. You can use two pieces of ribbon cable or individual wires for these cables.

The main cable requires 14 conductors. You can use a DIP jumper cable; these come with DIP plugs on each end. Cut off one plug and fan out the wires. Be certain to check the jumper for continuity end-to-end and for each wire since DIP jumpers sometimes have open pins.

We prefer to use 16-wire ribbon cable (cut from 20-wire ribbon) and double up the wires on pins 1 and 8. This improves the electrical characteristics of the unit and lets you add the stacked plug socket described earlier. The pull-down resistors R3, R4, and R5 need not be put inside the plug since they are on the board, but careful soldering is required to place 16 wires in so small a space.

Separate 2″ of ribbon on the board end of the cable into individual wires and trim them to the required length. The longest wire is the double ground that runs to the central bus. The +5 wires that run to the plus end of the cap are only a bit shorter. The rest of the wires connect along each side of socket 1. Each wire is trimmed, stripped, twisted, tinned, inserted into its hole, and soldered.

People with small hands have a definite advantage in doing this type of electronic work. You will find that a stand or clamp to hold the board is also a great help.

The cables should be laid down neatly and secured with a wire wrap. A 1″ thick block of white plastic foam, stiff but flexible, from a shipping box makes an excellent base for the unit. Cut out a hole for the switch and secure the board in place with a small amount of silicone sealant. If you are concerned about the exposed wires you could cover the top with a sheet of plastic with three holes cut into it.

Testing the Selection Switch

To test the selection unit, measure the resistance from pin 1 to pin 8 of each socket. The reading should be infinite at all switch positions. Inspect the solder side of the circuit board, looking for bridges between copper lanes and cold solder joints that have an excess of dark resin. To double check your work, ask a friend to check conductance wire-by-wire, with the multimeter on a low ohms setting, and color in the second photocopy of the schematic.

When you are satisfied that the circuit tests out correctly, plug in the selection socket and turn on the Apple. (We assume that you first turned off your computer if it was already on.) If the computer does not start up in a completely normal fashion, turn it off at once and recheck your work. If the computer starts up correctly, try the switch and watch the LEDs. Next, turn off the computer and plug a trusted paddle into your new socket extension. Start up the computer again and run a paddle check program (for an example of such a program, refer to "Rebuilding Game Paddles and Joysticks" in the February issue.)

If there are any bugs in the unit, they will quickly become apparent. Turn off the computer and carefully check the solder joints associated with any feature that didn't work properly. Most problems are visible on close inspection. Also, remember to test the stacked plug that is now inside the computer case.

Construction of Other Types of Extensions

Figure 5 is the circuit schematic for a two-person game multiple socket board. This unit has an on/off switch for both sockets and does not need isolation diodes. Pins 2 and 4, 6 and 7, and 10 and 11 are cross wired. Like the stacked plug, this circuit gives you the two-person game feature, but makes it available outside the Apple case.

Alternatively, you could make up a four-socket board that included both schematics (Figures 4 and 5), with a three-position rotary switch in the center. The rotary switch would direct power to socket 1, 2, or 3, while the fourth socket on the board would be attached to socket 3 as shown in Figure 5. Seven isolation diodes would be required for socket 3 (none for socket 4), but the connection to socket 4 would be located between the diodes and the sockets. But why stop at four sockets? There is no particular limit except the size of the circuit board.

Owners of computers other than the Apple will also find it beneficial to bring the game ports out of the case and add a choice switch. The type of plug is different for each computer, and of course the pin numbers will change. In many systems, all the plugs and sockets would be on short cables, with the switch, diodes, and resistors on a circuit board in the center. It will take some work to find the correct pin out information and locate a supplier for the connectors. Some systems may use pull-up resistors, connected to the +5 supply rather than the ground, instead of the Apple pull-down resistors. Other systems may not need resistors at all.

There is one other type of multiple control worth mentioning. The multiplexing control, for which the computer chooses the active control, is not used for games. When the control input is a measurement (for example, of temperature or light level) and you must log the measurements from more than four sensors automatically, you would use a multiplexing control. In this way you could monitor a solar hot water system or a science project. This type of multiple socket is quite similar to the units we have just described. We will try to cover the multiplexing control at a later date.

In Conclusion

The multiple socket extension is one of the most popular additions to the Apple and other personal computers. The home built version not only costs less than a commercial unit but has more features and is an excellent beginning project in computer hardware.

Next time we will discuss the construction of a sketch pad and digitizer. With this unit you can draw on a piece of paper and on the hi-res screen at the same time. You can also use it to enter information from charts and graphs directly off paper into the computer memory. □

outpost : atari

John Anderson

Is it possible that there is a touch of spring in the air? Could it be that those are buds on the trees? Can the sun be turning warm and rich with promise? Is it time for a young man's fancy to turn to thoughts of—yes—the viability of Atari marketing?

Maybe you are the kind of devout Atari follower who is offended by any critical comment aimed at the makers of your impressive array of hardware. I'll bet the last place you would want to encounter these is in the Outpost. If so, please skip ahead to our next topic.

Scuttlebytes

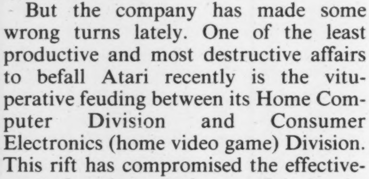
"What's good for General Motors," they used to say, "is good for the USA." Well that may or may not have ever been true, but it seems now that a good part of the USA is worried about Atari. From the *Wall Street Journal* to *Rolling Stone* magazine and ABC news, word has it that Atari is "demoralized," due in large part to the plummeting of Warner Communications stock in early 1983. It has lost 1.3 billion (yes folks, that's *billion*) dollars in share value since the end of last year, and when pressed for a reason, Warner points a shaky finger at Atari. It is only fair: when Warner was making more profits from Atari than all of its other subsidiaries combined, that was Atari's doing, too. They can now at least take the heat.

The thing that has Wall Street really skitterish is the fear that Atari will suck other video game interests down the drain with it if it goes the way of the Titanic. Companies such as Mattel are already hurting through no fault of their own. The key word is "saturation." Has the video games market reached "saturation"? If so, it is time to sell out and head for the lifeboats. Unsinkable Atari may have struck an iceberg, and America's economic waters are frigid. Backers and brokers first!

While remaining one of its most loyal fans, I have been a follower and sometimes vocal critic of Atari for some years now, observing its occasionally erratic market behavior. It is amazing to me, first of all, that Atari has survived its own remarkable rate of expansion. It is a credit to the company that it has held together through periods of growth so rapid that a more rigid organization might have shattered. And Atari did more than that—it continued developing quality products.

But the company has made some wrong turns lately. One of the least productive and most destructive affairs to befall Atari recently is the vituperative feuding between its Home Computer Division and Consumer Electronics (home video game) Division. This rift has compromised the effectiveness of each, and the proof is in the latest products.

At a time when categories of home computers and home entertainment machines are meshing, Atari has introduced the 5200 Supersystem, which is a somewhat redesigned Atari 400, undercutting and completely incompatible with it or any other Atari computer. This was a serious marketing error, especially coming from a company that prides itself on marketing savvy.



The infamous 5200 controller, with the slowest action in the West, East, or in between. It is also next to impossible to get one back together once it's apart.

The reason? Well the only one that I can posit is fear on the part of the powerful Consumer Electronics Division that it would be made obsolete or absorbed by the Home Computer Division, if the 400/800 became the games "heir apparent" to the ubiquitous VCS model 2600. Witness the introduction of a keyboard peripheral for the VCS that will be upwardly incompatible with any other Atari product. It just doesn't make sense.

Although the Supersystem is selling, it is up against some very stiff competition, and its poorly designed controllers detract seriously from game playability (they are even slower than those on the Bally Astrocade). I would much rather play the 400/800/1200 versions of its game cartridges to avoid the sluggish 5200 joysticks, which make Pac-Man play like he's stuck in quicksand. Whatever was on the design team's mind (I suspect the design of a single controller to act as paddle and joystick, and opening up the possibility of an analog trackball), they went wrong here.

Then there is the model 1200 XL computer, the Home Computer Division's "next generation." If it had been announced at $499 instead of $899, it would have been a welcome addition to the Atari computer line. As it stands, it is strike two for Atari. The 1200 has met with nearly universal insouciance in the microcomputer community, and for good reason. It has an extra 16K in a designer case, without a right cartridge slot, expansion slots, or a third and fourth controller jack. It has no standard parallel or RS-232 ports. Only substantive price cuts will help its image in any tangible way.

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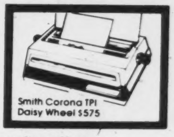

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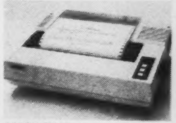

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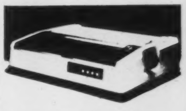

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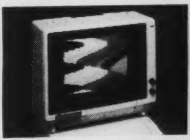

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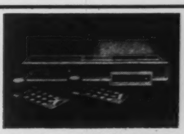

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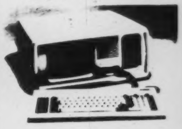

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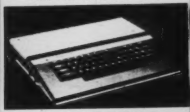

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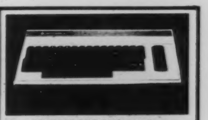

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Outpost: Atari, continued...

And what of the Atari 600? Well, it seems we may never see such a product, because word has it the Atari 600 has been postponed indefinitely. The reason? Nowhere to fit it into the product line. With the 800 now discounted to as low as $450, the 600 can't fit between the 400 and the 800 in pricing.

Even more damaging to the Atari Home Computer Division is the downright hostility that it has displayed to third-party support. It seems that marketing resents, and seeks to eliminate or absorb, those who develop third-party hardware. Interfacing is kept intentionally nonstandard, expansion slots are phased out, and potential interfacing controller jacks are removed. One of the more enlightened sales points of the original 800 was its modularity—it would never be obsolete, said Atari, because the operating system was on a plug-in board, as was RAM memory, and all could be replaced in a matter of seconds.

Well the new 800s are not modular. In fact, the memory slot area on the new 800 machines is no longer accessible! This means a new 64K OS for the 800 is not on the docket from Atari, and operating systems from other sources will be discouraged.

These moves constitute a very serious underestimation by Atari concerning the attitude of the home computer consumer. While the home user is in most cases not a computer "hacker," he should not be patronized, either. He might want modularity, 80 column capability, or bank-selectable RAM. He may see uses for the machine that nobody has yet dreamed, and should have every opportunity to realize those applications.

This is the kind of open-ended flexibility that made the Apple the most popular microcomputer of its day. It is the kind of attitude that Commodore is taking to get the model 64 off to a strong start. It is an attitude that Atari has continually misunderstood, discouraged, and somehow confused with piracy—"it's *our* machine," I imagine them saying, "*we'll* design the peripherals." They should really rethink that outlook, and quickly.

For if Atari misses with its next swing, reports of its death may not be so exaggerated. This is a fickle business, and the early lead of the VCS, as well as the inspiration that bred the magnificent 400 and 800, has now been spent. Atari must play it smart now. It can do so only by responding to the needs and desires of an increasingly discriminating and well-versed buyer.

Well enough of that. It is well known that the Atari is my favorite microcomputer, and it is time to underscore the positive side of that opinion.

Light Pen Revisited

Though it was years ago, I can still vividly remember my frustration. I was new to the Atari, and starved for programming applications to help me get the most from, and learn the most about, my machine. And there I was, having typed in a program from a magazine four hours on end, to discover not only that it didn't run, but that it *couldn't* run as it was printed. Sometimes I would be able to institute my own fix, and other times I couldn't. Sometimes the magazine would acknowledge the problem in a subsequent issue, and print a fix. Sometimes the flaw would never be addressed.

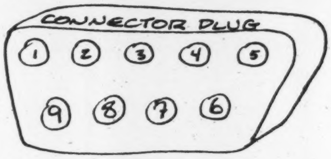
As a lasting result of these trials, I try very hard to make sure that everything that makes it into this column is correct when it gets here. It is hard for me to prove that assertion right this minute, however, because of a reversed figure, dropped program line, and lack of attention to the unique features of the Atari 400 in the March home-brew light pen column. This has caused a lot of consternation. All I can do is tender my sincere apologies, and set out the corrections.

The first person to bring these problems to my attention was my friend Greg Leslie, sysop of the GREKELCOM Atari BBS in Oklahoma City (give them a call 24 hours a day at (405) 722-5056). The patches for the 800 are as simple as a pair of switched wires and a missing program line, but that's quite enough to cause aggravating foulups for many readers. The touch ring on a pen constructed as originally indicated will not work, returning a PADDLE (0) value of 228 no matter what.

The touch switch is actually part of a circuit that feeds a small voltage from the wire loop, through the user, and into the body of the pen. The voltage feeds into pin 9 on port 1 of the computer, causing the PADDLE (0) value to dip below 228. With the pen body grounded, no voltage can flow. The following swap is needed:

Inside the pen, disconnect the loop wire from the wire that leads to pin 9. Then solder the loop wire to the end of the resistor that is *not* connected to the phototransistor. There should be another wire soldered there which goes to pin 7 on the DE-9 plug.

The wire that is friction-fit against the metal pen body needs to be disconnected from the emitter of the phototransistor and soldered to the wire that leads to pin 9 (the disconnected lead described above).



NOTE: THIS IS THE PLUG.
THE JACK WIRES UP IN
MIRROR IMAGE.
6 - (PENHOT) - DIRECTLY TO COLLECTOR
7 - (+5v) - TO RESISTOR AND TOUCH RING
8 - (GROUND) - TO EMITTER
9 - (PADDLE 0 HOT) - TO PEN BODY

Figure 1. This supercedes Figure 8 in the March Outpost.

Now, if all is well, the wire loop will be connected to +5v (pin 7), the pen body will be connected to the paddle input (pin 9), and the switch should work as advertised. A revised Figure 8 appears here as Figure 1.

As I first mentioned, it may be necessary to dampen your finger for best results. Pen sensitivity may also be improved by increasing the brightness control on your TV or monitor.

That's not all. Line 130 is missing from Figure 12, and should be exactly the same as line 130 in Figure 11: 130 Y=PEEK(565).

In addition, there are some hardware differences between the Atari 400 and 800 models which cause the light pen to be read from port 4 on the 400. If you have a 400, plug the pen into port 4 and substitute PADDLE(6) for all references to PADDLE(0) in the demo programs. From there everything should be peachy.

Jeepers. I'm sorry about that. I hope it didn't cause too many readers to throw their light pens in the trash. It really can be done, and with impressive results. Greg told me he was quite happy with his pen once he had worked out the gremlins, and that it compared favorably to some commercial models.

And I promise I'll check possible patches for the 400 on all hardware projects to come! I've had a lesson on those differences here, as well as the need for triple-checking of figures and listings.

Programming Utilities

Have you ever wished you had a program editor for developing Atari Basic or assembler code? The Atari Program-Text Editor, available from APX, has

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CIRCLE 167 ON READER SERVICE CARD

long been the only sophisticated tool available in this category. Now a new and powerful entry, *ERedit* brings over 25 separate editing commands to the disposal of the Atari programmer.

Among its standard features are commands to search for strings, search and replace strings, move, copy, insert, and delete portions of the files; full cursor control; file comparison; formatting of disks; locking and unlocking, as well as renaming of files, and renumbering.

In addition, the editor provides in-depth help functions for each of its commands, and best of all, English error messages when the master disk is accessible in drive 1.

The program supports multiple drive systems as well as printers.

Once you use an editor such as *ERedit* to aid program development, you'll never want to work "raw" again. The tedious and sometimes dangerous editing processes (beware the infamous keyboard lock-up syndrome) are made fussless and trouble free.

ERedit is a new product, and its retail price was not fixed at press time. It requires a 24K system with at least one disk drive. For more information contact EHR3 Inc., 174 Summit Ave., Summit, NJ 07901. (201) 277-6785.

Another product that can be of massive help during programming is *Basic Commander*, from MMG Micro Software. It contains a mini-DOS, allowing the user to list, save, enter, load, run, delete, lock, unlock, and format disks, without needing to invoke the main DOS program. "But many mini-DOS programs are on the market with similar features," you may say. Well, *Basic Commander* also features automatic line numbering, block delete, and transparency during use. "All well and good," state the skeptics, "but *ERedit* and *Monkey Wrench* do those things just fine." Yeah, but do they allow three user-programmable function keys for simultaneous macro definition? This program does, and it is a very convenient potential.

For example, you might assign the keystrokes CONTROL-L to the string "LOAD D1:", CONTROL-S to the string "SAVE D1:", and CONTROL-R to the string "RUN D1:". Cursor placement can then be determined within the macro so that the user need only type the file name and RETURN to execute the desired command. Or the string can just as easily be embedded within a bit of code. Who says the IBM can do things that the Atari can't?

This is another of the category of features that a programmer learns to lean on during program development, and would from that moment on miss dearly were they not available.

Basic Commander lists for $34.95. For more information, contact MMG Micro Software, P.O. Box 131, Marlboro, NJ 07746.

DOS Access from Forth

Valpar International has added yet another package to its growing ValForth series, which is without a doubt the foremost Forth implementation available for the Atari computer. This new package is *ValDOS*, which allows access to conventional DOS files from the Forth environment. Think of it: no more incompatibility between Forth screens and DOS files.

The *ValDOS* package is documented in the same professional manner as previous ValForth packages, and retails for $45. This includes a file editor that allows Forth code to be saved in DOS format.

For more information, contact Valpar International, 3801 E. 34th St., Tucson, AZ 85713. (602) 790-7141.

Reference Books Revisited

In the December 1982 Outpost, we took a look at reference books for the Atari computer owner. These ranged from books for the child or beginner to advanced technical notes for machine language programmers. Let's add to that list the following new titles:

Atari Programming With 55 Programs, by Linda M. Schreiber. 244 pp. TAB Books, Blue Ridge Summit, PA 17214. This crisply organized introduction to programming uses generic information alongside an Atari-specific manual to approach the fundamentals of Basic. Programs are neat and really do work. There are nicely presented techniques to dispel the fears of flowcharting so common in beginners (and not-so-beginners) and the best description of error-trapping I've seen in an Atari work. The book offers quick immersion into assembler and then sets you back out again before shock can set in. It would be even nicer if it came with a disk.

Inside Atari Basic, by Bill Carris. 181 pp. Reston Publishing, Reston, VA 22090. Word has it that this book will replace *Atari Basic* in the carton accompanying Atari computers, and it is an improvement over that beginner's text (though not of the caliber of *Your Atari Computer*). Carris touches on basic points with humor and common sense. The book is quite short, and therefore necessarily rather shallow most of the time, but of great help to the beginner. It is not for the intermediate or advanced programmer.

And heaven save me from the inveterate programming punster. Ever take note of how often "programming-made-painless" texts inflict sadistic puns at every turn? Best (worst) one in this book: "Hip Hip Array." As my buddy Arlan says, somebody please gag that man with a spoon.

Understanding Atari Graphics, by Michael Boom. 49 pp. Alfred Publishing, Sherman Oaks, CA 91403. Though really not much more than a tall pamphlet, this work contains a great deal of valuable reference material pertaining to Atari graphics, including a keypress to ATASCII character chart, which can be

"I suppose someday they'll be replaced by a single chocolate chip."

found in no other reference I have seen, and a color chart showing the hues available with SETCOLOR commands. It also contains interesting material pertaining to the GTIA chip. I just wish there were more than 49 pages available to the author, so he might have taken up a meaty subject or two, like player-missile graphics or display list manipulation.

The Visicalc Book, Atari Edition, by Donald H. Beil. 298 pp. Reston Publishing, Reston, VA 22090. The best *Visicalc* reference around is now in an edition to complement *Atari Visicalc.* This primer on accessing the real power of the program, and the creation of templates to best serve user's needs, is available in hard and softcover editions.

There are at least a couple of other new publications on the Atari now appearing, and I hope to get a look at them soon. I will report my book findings again shortly.

Supertext Revisited

I created a monster. When I posed a challenge to readers of the February column to send in a self-modifying version of the title card generator I had written, I little expected to be buried in a blizzard of entries (we've had enough blizzards out this way for one year, thank you). I wish I could reply to everybody personally, but that just isn't possible. If you receive mystery software in the mail, it is probably from me. And my thanks to you for participating, and for the many words of encouragement you sent. As many of you have suggested, I hope to pose another challenge in an upcoming column.

As promised, in a month or so you will see an entire self-modifying supertext program, encompassing the best of the many techniques we have seen for accomplishing it. In the meantime, I'd like to single out a few contestants for programs that showed, for one reason or another, what I thought was exceptional originality, elegance, or cleverness.

The names of these people appear as Figure 2. The order of the names does not represent any sort of ranking, but merely the order in which they were received. I salute these folks, whose programming savvy in many cases far exceeds mine, and wish them the best in their further efforts on the Atari, as well as in all of their endeavors.

Mail Bag Revisited

While we're revisiting so many things, I shall take an opportunity to answer a few of the many questions that have come my way. Yes, there will be a Logo for the Atari, and we should see it some time soon. It will be on a 16K ROM cartridge. Yes, there will be a 16K Microsoft Basic ROM cartridge as well, but no, Microsoft is not built into the 1200 XL. Nice thought, though. Nor do I know much about the rumored new graphics modes of that machine, as we still have not received one at the lab.

In answer to a common query, I unfortunately know of no way to toggle off the internal speaker through software. I attached a toggle switch to the underside of my original 800, and pulled the speakers entirely from two other units I use regularly. A description of the speaker switch project will appear in next month's Outpost. The 1200, by the way, has no internal speaker at all, and routes its beeps, glurps, and gurgles to the TV or monitor speaker. Apparently I was not the only Atari user being driven slowly looney by keyclick and razzes.

Until next time, do try to keep your Computing Creative . . . □

Contest Entries Of Special Merit

Kaiwing Kenner, Great Falls, VA
Mark Warner, Milwaukee, WI
Fred Tedsen, Sonoma, CA
Page Starr, Philadelphia, PA
Dave Adair, Cuyahoga Falls, Ohio
Sol Guber, Saint Louis, MO
Alan Belke, Belvidere, IL
Eric Vaterlaus, Beaverton, OR
Harold Watson, Dayton, OH
Rod Smoliak, New Hope, MN
Scott Zimmerman, Salt Lake City, UT
David Thigpen, Killen, AL
Adam Kao, Walnut Creek, CA
Jim Lauman, Oregon City, OR
Larry West, Burlington, Ontario
Jeffrey Olkin, North Miami Beach, FL
James Brezden, Northglenn, CO
Debby Keen, Raccoon, KY
Richard Cole, Mobile, AL
Brian Fitzpatrick and
  Gary Herzenstiel, Lansing, MI
David Brandman, Manchester, MO
Richard Kulas, Winona, MN
John Davis, Lubbock, TX
Alfred Arnold, Mountain Home, ID
Jorge Villasenor, Mexico City, Mexico
Brian Biggs, Falls Church, VA
Eldon Black, Colorado City, AZ
Timothy Connor, Saint Petersburg, FL
Philip Kreiker, Loveland, CO
Alfred Louie, Flushing, NY
Allen Warren, Tyler, TX
Alan Stockbridge, Grand Ledge, MI
Gordon Oppenheimer, Milford, CT
Gordon Burnham, Orlando, FL
Dick Peterson, Lansing, MI
Mark Odendahl, Bloomington, MN
Paul Richard, Maurepas, LA

Figure 2. The honor roll.

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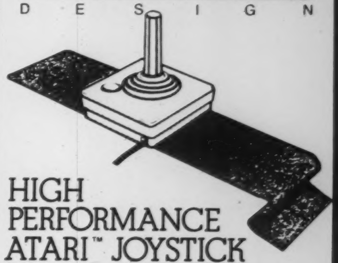
D E S I G N



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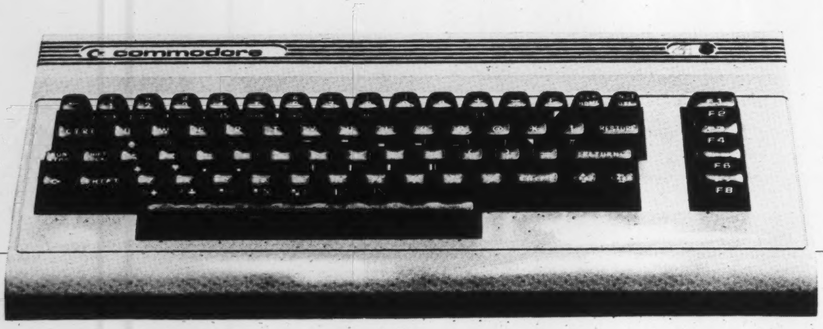


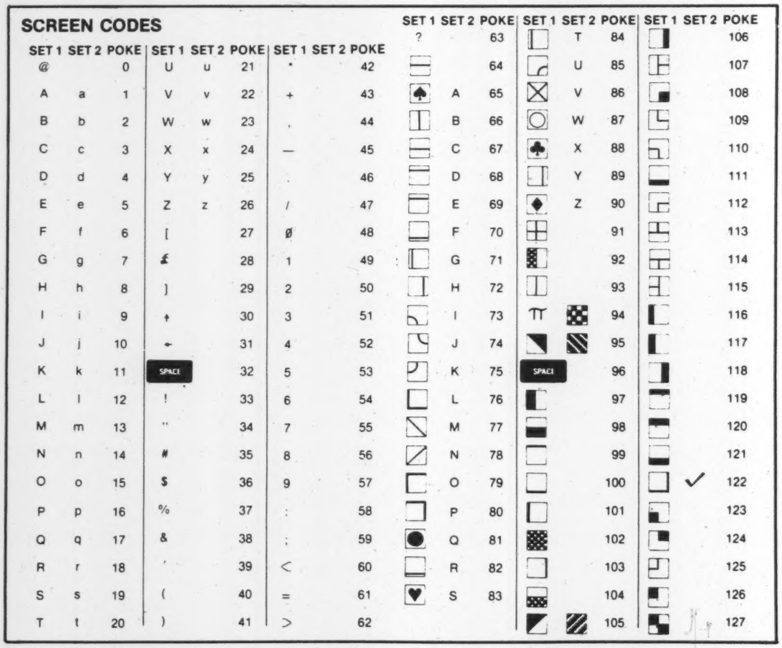
Joel Swank

Our guest columnist this month is Joel Swank, who will present a tutorial concerning screen manipulation with the Vic-20. If you have questions for Mr. Swank, please contact him directly at 12550 SW Colony #3, Beaverton, OR 97005.—JJA

Expanding the Vic 20 Screen

Most Vic owners know that the Vic displays information on a screen that has 23 lines of 22 characters each. Routines in the Vic KERNAL (control program) take care of formatting output to match this screen size. But the Vic is not limited to this screen configuration. In fact, the 6560 VIC (Video Interface Chip) TV controller IC (Integrated Circuit) can display a wide variety of other screen formats. After the 6502 microprocessor IC that controls all operations in the VIC, the 6560 is the most important. It generates the color display and sound that are the most impressive features of the Vic.

The Vic uses a technique called memory-mapped video for displaying information on a TV. This technique is



SCREEN CODES

SET 1	SET 2	POKE	SET 1	SET 2	POKE	SET 1	SET 2	POKE	SET 1	SET 2	POKE	SET 1	SET 2	POKE	SET 1	SET 2	POKE
@		0	U	u	21	*		42	?		63	▏	T	84	▐		106
A	a	1	V	v	22	+		43	─		64	╭	U	85	├		107
B	b	2	W	w	23	,		44	♠	A	65	╳	V	86	▗		108
C	c	3	X	x	24	—		45	│	B	66	○	W	87	└		109
D	d	4	Y	y	25	.		46	─	C	67	♣	X	88	┐		110
E	e	5	Z	z	26	/		47	▔	D	68	▕	Y	89	▂		111
F	f	6	[		27	0		48	▔	E	69	♦	Z	90	┌		112
G	g	7	£		28	1		49	▁	F	70	┼		91	┴		113
H	h	8	]		29	2		50	▏	G	71	▒		92	┬		114
I	i	9	↑		30	3		51	▕	H	72	│		93	┤		115
J	j	10	←		31	4		52	╮	I	73	π	▒	94	▎		116
K	k	11	SPACE		32	5		53	╰	J	74	◥	▧	95	▍		117
L	l	12	!		33	6		54	╯	K	75	SPACE		96	▐		118
M	m	13	"		34	7		55	└	L	76	▌		97	▔		119
N	n	14	#		35	8		56	╲	M	77	▄		98	▀		120
O	o	15	$		36	9		57	╱	N	78	▔		99	▃		121
P	p	16	%		37	:		58	┌	O	79	▁		100	┘	✓	122
Q	q	17	&		38	;		59	┐	P	80	▏		101	▖		123
R	r	18	'		39	<		60	●	Q	81	▒		102	▝		124
S	s	19	(		40	=		61	▁	R	82	▕		103	┘		125
T	t	20	)		41	>		62	♥	S	83	▄		104	▘		126
												◤	▨	105	▚		127

Table 1. A list of the screen code for each Vic character. Two possible characters can be displayed for each code, depending on which of the Vic's two standard character sets is being used. Vic character sets can be switched by pressing the shift and Commodore keys at the same time.

Reprinted from the Vic-20 Programmers Manual courtesy of Commodore Inc.

common among low cost computers. With memory-mapped video, a section of the computer memory or RAM (Random Access Memory) serves a dual purpose. It appears to the microprocessor as normal memory, but is also used by the video interface to determine what is displayed on the screen. Each byte of memory determines what pattern of dots is displayed in each area, or character, of the screen.

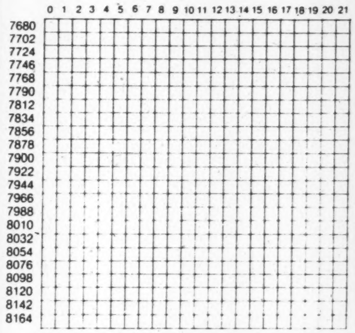
The video controller reads this section of memory every thirtieth of a second and displays it on the TV. So, whenever the microprocessor alters a byte of this memory, the change is immediately visible on the screen. This special section of memory is called the screen buffer. Each byte in the screen buffer contains the number, called the screen code, of the character that is to be displayed in one part of the screen.

If the display is to have color there must also be a section of memory that determines the color of the characters on the screen. This is called the color buffer. Each byte of the color buffer determines the color of one character. So, each character on the screen must have one byte that determines its pattern of dots and one byte that determines its color.

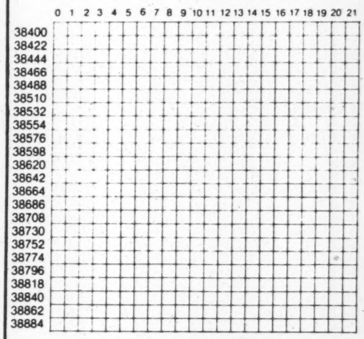
Table 1 is a list of the screen codes for each Vic character from page 141 of the Vic user's manual. Table 2 is a list of the Vic color codes from page 144 of the user's manual.

To place a character directly onto the screen, first look up the screen code of the character in Table 1 and the location of the desired spot on the screen in the top half of Figure 1. Then POKE the screen code into the desired location. For example, to place an asterisk on the third character of the tenth row, type POKE 7880,42.

If you do this on an empty screen you will not see the character. This is because the color code in the color buffer is still set to white, the screen color. Now find the location in the color buffer of the desired spot on the screen from the



PAGE 1: SCREEN CHARACTER CODES



PAGE 2: COLOR CODES MEMORY MAP

Figure 1. Maps of the Vic screen buffer and color buffer. Codes from Table 1 are POKEd into the page 1 of this figure to place characters on the screen. Color codes from Table 2 are POKEd into locations on page 2 of this figure to set the color of each character.

APPENDIX I: SCREEN MEMORY MAPS

Use this appendix to find the memory location of any position on the screen. Just find the position in the grid and add the numbers on the row and column together. For example, if you want to poke the graphic "ball" character onto the center of the screen, add the numbers at the edge of row 11 and column 11 (7900 + 10) for a total of 7910. If you poke the code for a ball (81, see Appendix H) into location 7910 by typing POKE 7910,81, a white ball appears on the screen. To change the color of the ball (or other character), find the corresponding position on the color codes memory map, add the row and column numbers together (38620 + 10, or 38630) for the color code and type a second poke statement. For example, if you poke a color code into this location, POKE 38630,3 the ball will change color to cyan. Note that when POKEing, the character color numbers are one less than the numbers on the color keys—as shown below.

Abbreviated List of Color Codes:

Code	**Color**
0	Black
1	White
2	Red
3	Cyan
4	Purple
5	Green
6	Blue
7	Yellow

Table 2. The color codes for the Vic character colors.

Location		
Hex	Decimal	Function
9000	36864	Horizontal centering and interlace scan
9001	36865	Vertical centering
9002	36866	Characters per line and screen buffer address
9003	36867	Lines per screen and character size
9004	36868	TV raster beam line
9005	36869	Character pattern address and screen buffer address
9006	36870	Horizontal position of light pen
9007	36871	Vertical position of light pen
9008	36872	Digitized value of paddle X
9009	36873	Digitized value of paddle Y
900A	36874	Sound port low frequency
900B	36875	Sound port medium frequency
900C	36876	Sound port high frequency
900D	36877	Sound port noise
900E	36878	Volume of sound and auxiliary color
900F	36879	Screen and border color

Table 3. The location and use of the 16 registers used to communicate with the 6560 Video Interface Chip.

```
100 REM STOPWATCH PROGRAM
200 REM
300 REM F1 = START
400 REM F3 = STOP
500 REM F5 = CLEAR
600 REM F7 = END PROGRAM
700 REM
800 REM WILL NOT WORK WITH PROGRAMMERS AID
900 REM THIS PROGRAM MOVES THE SCREEN : RESET AFTER USING
1000 POKE648,30:SYS58648:POKE 52,30:POKE56,30:CLR
1100 C=PEEK(646):POKE646,2:GOSUB 1900:POKE646,C
1200 GOSUB 4600:GOSUB 2600
1300 GET A$: IF A$="" THEN 1700
1400 A=ASC(A$)-132
1500 IF A<1 OR A>4 THEN 1700
1600 ON A GOSUB 3400,4000,4600,5100
1700 IF O<>0 THEN GOSUB 2600
1800 GOTO 1300
1900 REM SCREEN INIT SUBROUTINE
2000 POKE 36867,48
2100 FOR I=37888 TO 37888+16:POKE I,1:NEXT
2200 FOR I=8186 TO 8186+6:POKE I,32:NEXT
2300 FOR I=38906 TO 38906+6:POKE I,PEEK(646):NEXT
2400 RETURN
2500 REM CLOCK UPDATE SUBROUTINE
2600 TT$=TI$
2700 POKE 8187,ASC(MID$(TT$,3,1))
2800 POKE 8188,ASC(MID$(TT$,4,1))
2900 POKE 8189,58
3000 POKE 8190,ASC(MID$(TT$,5,1))
3100 POKE 8191,ASC(MID$(TT$,6,1))
3200 RETURN
3300 REM START STOPWATCH
3400 IF O=1 THEN RETURN
3500 TI$=TT$
3600 O=1
3700 PRINT"START"
3800 RETURN
3900 REM STOP STOPWATCH
4000 IF O=0 THEN RETURN
4100 TT$=TI$
4200 O=0
4300 PRINT"STOP"
4400 RETURN
4500 REM CLEAR STOPWATCH
4600 TT$="000000"
4700 TI$=TT$
4800 PRINT"CLEAR"
4900 GOSUB 2700
5000 RETURN
5100 PRINT"END"
5200 END
READY.
```

Listing 1. Stopwatch program. A stopwatch is displayed on the expanded Vic screen.

second half of Figure 1, and the code for the desired color from Table 2, and POKE the color code into the color buffer: POKE 38600,2. Since 2 is the code for red, a red asterisk should now appear on row 10, character 3.

This technique can be used to place any character of any color anywhere on the screen.

Mapping The Display

The details of how the computer memory is used to map the display vary from one video controller to another. Many controllers have a fixed format and a fixed character set. The Vic 6560 controller has registers that allow the computer to change the way the 6560 displays memory. This adds a great deal of flexibility not found in simpler video controllers.

Table 3 gives a summary of the registers in the 6560. These registers control the size and format of the Vic screen, the color of the screen and border, and the location in memory of the screen buffer and color buffer. They also control other functions of the 6560 not normally found in a video controller, such as sound, game paddle inputs, and light pen. A complete description of all registers in the 6560 is given in the Vic programmer's reference guide, starting on page 212.

I will now explain and give some examples of using five of these registers to change the size and location of the Vic screen. Vic addresses will be given in decimal and hexadecimal for convenience. Hexadecimal numbers will be denoted with a leading dollar sign ($).

The first two registers in the 6560 are the horizontal and vertical centering registers, located at 36864 ($9000) and 36865 ($9001). These are used to center the Vic screen within the border. Location 36864 is the horizontal control register. Increasing the value in this register moves the screen to the right, while decreasing the value moves the screen to the left.

The high order bit of this register is used for another function (interlace scan), so it should always be off. This means that the valid range for horizontal centering is 1 to 127.

Location 36865 controls the vertical position of the Vic screen within the border. Increasing the value in this register causes the screen to move down, and decreasing the value causes the screen to move up. The valid range of this register is 0 to 255. You can experiment with these registers by POKEing different values into them and watching the change in screen location. Pressing the STOP/RUN and RESTORE keys will restore them to the default values.

The next two registers in the 6560 control the line length and the number of lines on the screen. Location 36866 ($9002) controls the number of characters per line. Only the low order seven bits of this register are used for line length. Bit 7 is part of the screen buffer address and should not be changed.

This should allow from one to 127 characters per line, but the 6560 will accept no more than 29 characters per line. Location 36867 ($9003) controls the number of lines on the screen. This value is kept in bits 1-6. Bits 0 and 7 are used for other functions. Six bits allow from one to 63 lines on the screen.

The Vic screen can be from one to 63 lines or from one to 29 characters. Just how much of the screen is actually visible at one time depends on the TV being used. Some TVs can barely display all of the standard Vic screen. Others display the screen with a wide border. My Sony can display a maximum of about 30 lines of 24 characters.

Some TVs have vertical and horizontal size adjustments on the back that can be used to increase the amount of picture displayed. If these controls are external they can easily be adjusted. If they are internal, you can only change them by operating the TV with the back off, a dangerous proposition. Operating the TV with the back off should be left to experienced TV service personnel. The high voltages found in a TV can destroy the delicate circuits in the Vic. I have seen ICs actually explode when subjected to such voltages.

An expanded screen is not compatible with the Vic KERNAL. The KERNAL works properly only with the standard 22 x 23 screen. This means that PRINT statements and the cursor movement keys will not work properly. Things must be displayed by POKEing screen codes into the screen buffer, and color codes into the color buffer. Also, if you expand or move the screen, the maps in Figure 1 are no longer valid, and must be redrawn to match the new screen configuration.

The screen buffer normally resides at location 7680 ($1E00) through location 8185 ($1FF9). Vic memory ends at loca-

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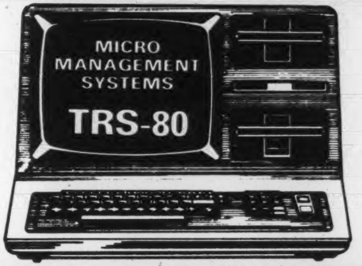

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tion 8192 ($1FFF), leavng only six bytes for expansion. To expand the screen more than six bytes, the screen buffer must be relocated. But it is possible to expand the screen and use only these six bytes.

Stopwatch Program

Listing 1 is a short Basic program that makes use of these six bytes to display a stopwatch. It enlarges the screen by one line to 24 lines, but does not change the line length. Leaving the line length the same allows the KERNAL to be used to display information on the top 23 lines of the screen.

Since memory ends at location 8191, only the first six bytes of the new line are usable. The other 16 bytes are displayed from the Vic ROMs and cannot be changed. These 16 characters are blanked by storing the screen color (white) in their color buffer locations starting at location 37888 ($9400).

The first six characters of the last line are used to display a four-digit stopwatch. The Vic's jiffy clock is used to keep time. The function keys also print their functions on the screen each time that they are pressed.

As the program runs and keys are pressed, the screen behaves normally. Lines scroll up just as they should, except that the line with the stopwatch is never used. KERNAL does not know about this line, and PRINT statements can never access it.

The only way to display anything on the last line is to POKE screen codes directly into the screen buffer. This means that the normal ASCII characters must be converted into screen codes. For numeric digits this is easy, since their ASCII code is the same as their screen code and can be converted by the Basic ASC function. Table 1 can be used to convert other characters from ASCII to screen codes.

Expanding The Screen Further

Expanding the screen further requires that the screen buffer be moved. Moving the screen buffer means telling the 6560 the new screen buffer address and also notifying the KERNAL and Basic of the move. Listing 2 is a Basic program that moves the screen buffer to location 7168 ($1C00).

Basic is informed about the new location by POKEing 28 into locations 52 and 56 and executing a Basic CLR command. This tells Basic not to use any memory above memory page 28 ($1C). The KERNAL is notified by POKEing 28 into location 646, and calling the KERNAL subroutine at 58648 ($E518) to initialize KERNAL pointers. This subroutine also stores the new screen buffer location in the 6560 registers.

```
100 REM     TIME OF DAY CLOCK
200 REM
300 REM SET TI$ BEFORE RUNNING
400 REM USE CURSOR KEY TO CENTER SCREEN
500 REM THIS PROGRAM MOVES THE SCREEN : RESET AFTER USE
600 POKE52,28:POKE56,28:POKE51,0:POKE55,0:CLR
700 C=PEEK(646):POKE646,5:GOSUB 2100:POKE646,C
800 GOSUB 2700
900 GET A$:IF A$=""THEN 800
1000 IF ASC(A$)=17 THEN1500
1100 IF ASC(A$)=145 THEN1800
1200 PRINTASC(A$);
1300 IF POS(X)>18 THENPRINT
1400 GOTO800
1500 T=PEEK(36865):T=T+1:IF T>255 THEN T=0
1600 POKE36865,T
1700 GOTO 800
1800 T=PEEK(36865):T=T-1:IF T<0 THEN T=255
1900 POKE36865,T
2000 GOTO 800
2100 REM CLOCK INIT SUBROUTINE
2200 FOR I=7674 TO 7674+65:READJ:POKE I,J:NEXT
2300 FOR I=38394 TO 38394+64:POKE I,PEEK(646):NEXT
2400 POKE 648,28:SYS58648
2500 POKE 36867,52
2600 RETURN
2700 H$=MID$(TI$,1,2)
2800 H=VAL(H$)
2900 IF H<12 THEN P=1
3000 IF H=>12 THEN P=16:H=H-12
3100 IFH=0 THEN H=12
3200 H$=STR$(H):IF LEN(H$)=3 THEN H$=MID$(H$,2,2)
3300 POKE 7702,ASC(MID$(H$,1,1))
3400 POKE 7703,ASC(MID$(H$,2,1))
3500 POKE 7704,58
3600 POKE 7705,ASC(MID$(TI$,3,1))
3700 POKE 7706,ASC(MID$(TI$,4,1))
3800 POKE 7707,58
3900 POKE 7708,ASC(MID$(TI$,5,1))
4000 POKE 7709,ASC(MID$(TI$,6,1))
4100 POKE 7711,P
4200 POKE 7712,13
4300 RETURN
4400 DATA 32,32,32,32,32,112,64,64,64,64,64,64,64,64,64,64,6
     4,110,32,32,32,32
4500 DATA 32,32,32,32,32,93,32,32,32,32,32,32,32,32,32,32,32
     ,93,32,32,32,32
4600 DATA 32,32,32,32,32,109,64,64,64,64,64,64,64,64,64,64,6
     4,125,32,32,32,32
READY.
```

Listing 2. Time of day clock program. The Vic screen is expanded by three lines and relocated so that a digital clock can be displayed.

The new number of lines must be inserted into the 6560 register at 36867 ($9003) and must be stored in bits 1 through 6 of this register, not using bits 0 and 7. To do this, the number of lines must be doubled. So to tell the 6560 26 lines, 52 must be POKEd into this register.

In this program the screen is expanded by three lines to 26 lines, and a full time of day clock is displayed in the three extra lines. Before this program is RUN the Vic jiffy clock must be set by entering the current time into the variable T1$. Twenty-four hour clock time must be entered. For example to set the current time to 6:33 p.m., TI$="183300" would be entered. A full six digits must always be entered.

The program updates the clock display as it waits for input. When a key is pressed, its ASCII equivalent is displayed on the normal Vic screen. Once again the extra lines at the bottom are not affected by printing on the normal Vic screen.

Depending on the TV being used, all of the three extra lines may or may not be visible. The screen can be centered by pressing the cursor up/down key. When it is pressed, the program scrolls the entire screen up or down by incrementing or decrementing the vertical centering register in the 6560.

These three extra lines on the screen could be used for a wide variety of other things. A program could put status information there or a trace of where the program is executing. Any desired information can be displayed totally independently of what is happening on the standard screen.

It is also possible to expand the width of the screen by increasing the value in the line length register at location 36866 ($9002), but doing this makes Basic PRINT statements totally unusable. All data to be displayed anywhere on the screen must be POKEd into the screen buffer. Expanding the screen this way is most useful for graphic displays such as video games.

The Vic has great flexibility in its screen format. There are many more possibilities than the simple examples given here. You can use this flexibility to add a personal touch to your applications and tailor the display to the specific needs of each application. Using the techniques presented here, you can make your programs easier and more pleasant to use. □

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CIRCLE 214 ON READER SERVICE CARD

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Will Fastie

Here we go with another technical column, this time for you fans of Basic. Wait a minute, don't go away yet! Even if the word *technical* scares you, I think you might find the results of my work this month of some interest, and for a variety of reasons.

First and foremost, I have kept my promise to demonstrate how to interface Basic with routines in BIOS. Second, I have chosen to interface to the routine that handles scrolling of windows, since this is the only major feature of the video display system that is not directly available to the Basic programmer. Third, I have uncovered some interesting facts as a result of my work. Finally, the window handling routine is a handy one in general.

And don't be scared off by the assembly language routine printed herein: I'll show you how to use the routine without having to own or use the assembler. What's that? Still scared? Okay, forget it. I'll see you next month.

But if you're still here, let's get to work.

The Problem

Basic, of course, is the only programming language that is immediately available to the IBM PC owner. It comes "free" with the operating system. Basic is well known, and pretty easy to learn, so it is in widespread use. As a professional programming tool, it leaves much to be desired, but its combination of price and distribution are compelling.

Basic is often not well suited to the task at hand, especially if performance is an issue. This can partly be solved with the Basic Compiler, a truly valuable asset to the Basic program developer. However, there are some things which even the Basic Compiler cannot deal with, and an entirely different set of things which the language can handle, but for which assembly language provides considerably more performance. We will discuss a feature that falls in the first category, something for which assembly language *is* required. The feature is the control of independent "windows" on the display screen.

As you probably know, the PC is delivered with a considerable amount of software in Read Only Memory (ROM). Part of this is the resident Basic interpreter, but the other part is called BIOS, for Basic Input/Output System. The so-called "primitive" routines for handling most of the devices which can be attached to the PC are part of BIOS, including a very large section devoted to the video display devices, both color and monochrome. One of the features supported by the video I/O section is scrolling. Two routines are provided, one for scrolling up and one for scrolling down.

Scrolling is the act of moving all the lines of text on the screen up (or down) by a line (or more). The top (or bottom) lines disappear from view, as if they had passed behind the edge of the screen. The space created at the bottom (or top) of the screen is usually blanked by the scrolling operation so that the program can insert new information for display. It is easy to see the effect simply by pressing the ENTER key repeatedly at the DOS prompt: sooner or later you get to the bottom of the screen and the display at the top begins to rise and go away.

The PC version of scrolling is very sophisticated, both because it can go either up or down and because it can be applied to a rectangular window anywhere on the screen. Since the BIOS program provides only the scrolling function and not the *management* of windows, the application program is free to operate as many windows as are needed. And that is a vital point: your program does the real work, while BIOS provides a little bit of very fast help.

The Demonstration

Listing 1 is the program I wrote in Basic to demonstrate how windows and scrolling work. It uses two routines, SCROLLUP and SCROLLDN, which I will describe in a minute. It allows you to give scrolling commands and watch the effect of the command on the display.

W.H. Fastie, Suite 211, The World Trade Center, Baltimore, MD 21202. Correspondence can only be acknowledged when a stamped, self-addressed envelope has been provided. Source Address: TCP 394.

Listing 1.

```
1000 ’ Program to demonstrate interface routine to BIOS video scroll function
1010 ’
1020 ’ Author:  Will Fastie
1030 ’ Source:  DEMO.BAS
1040 ’ Created:  15 Jan 83
1050 ’ Edited:   07 Feb 83  1100
1060 ’
1070 ’ This program defines three windows on the screen.  Two are filled with
1080 ’ text and occupy the first 22 lines on the screen, half to each.
1090 ’ The third occupies 3 lines at the bottom, and is the command and status
1100 ’ area.  The commands that can be given are:
1110 ’
1120 ’  W       selects Top or Bottom window
1130 ’  S       scrolls the selected window Up or Down
1140 ’  C       clears the selected window
1150 ’  F       fills the selected window with new text
1160 ’  A       sets the scroll line attribute.  Default is white on black.
1170 ’  R       reset:  clear screen, reset attributes, start over
1180 ’  X       exits the program.
1190 ’ ----------
1200 ’ Initialize memory and load the machine code interface routine.
1210 CLEAR ,32000          ’ <-------- Depends on your memory size !!
1220 BLOAD "scroll.abs"
1230 DEF SEG = &H1FFC      ’ <-------- Depends on your memory size !!
1240 SCROLLUP = 0
1250 SCROLLDN = &HE
1260 ’ ---------- Setup the screen and initialize the control parameters
1270 DIM ULR%(3), ULC%(3), LRR%(3), LRC%(3), ATTR%(3)
1280 ULR%(1) = 0:  ULC%(1) = 0:  LRR%(1) = 9:  LRC%(1) = 79
1290 ULR%(2) =11:  ULC%(2) = 0:  LRR%(2) =20:  LRC%(2) = 79
1300 ULR%(3) =22:  ULC%(3) = 0:  LRR%(3) =23:  LRC%(3) = 79
1310 GOSUB 1790  ’ reset screen
1320 ’ ---------- Command Processing Section
1330 PROMPT$ = "Enter command:  ": GOSUB 1670
1340 X = INSTR("WSCFAXR",C$)
1350 IF X = 0 THEN BEEP: GOTO 1330
1360 ON X GOSUB 1380, 1430, 1500, 1540, 1620, 1650, 1790
1370 GOTO 1330
1380 ’ ---------- Select Window
1390 PROMPT$ = "Which window, T or B?  ": GOSUB 1670
1400 IF C$ <> "T" AND C$ <> "B" THEN BEEP: GOTO 1390
1410 IF C$ = "T" THEN W = 1 ELSE W = 2
1420 RETURN
1430 ’ ---------- Scroll Current Window
1440 PROMPT$ = "Which way, U or D?  ": GOSUB 1670
1450 IF C$ <> "U" AND C$ <> "D" THEN BEEP: GOTO 1440
1460 GOSUB 1740: INPUT "Enter number of lines to scroll:  ",NRLINES%
1470 IF NRLINES% < 0 THEN BEEP: GOTO 1460
1480 IF C$ = "U"
     THEN CALL SCROLLUP (NRLINES%, ULR%(W), ULC%(W), LRR%(W), LRC%(W), ATTR%(W))
     ELSE CALL SCROLLDN (NRLINES%, ULR%(W), ULC%(W), LRR%(W), LRC%(W), ATTR%(W))

1490 RETURN
1500 ’ ---------- Clear Current Window
1510 NRLINES% = 0
1520 CALL SCROLLUP (NRLINES%, ULR%(W), ULC%(W), LRR%(W), LRC%(W), ATTR%(W))
1530 RETURN
1540 ’ ---------- Fill Current Window with Text
1550 NRLINES% = 1
1560 FOR I = 1 TO 10
1570   CALL SCROLLUP (NRLINES%, ULR%(W), ULC%(W), LRR%(W), LRC%(W), ATTR%(W))
1580   LOCATE LRR%(W)+1, ULC%(W)+1
1590   PRINT USING "This is line ## of 10 lines of text in window #";I;W;
1600 NEXT I
1610 RETURN
1620 ’ ---------- Set Attribute for scrolled line
1630 GOSUB 1740:  INPUT "Enter new attribute:  ",ATTR%(W)
1640 RETURN
1650 ’ ---------- Exit Program
1660 END
1670 ’ ---------- Input command character and upperfy
1680 GOSUB 1740: PRINT PROMPT$;
1690 C$ = INKEY$: IF C$ = "" THEN 1690
1700 C$ = LEFT$(C$,1)
1710 IF C$ >= "a" AND C$ <= "z" THEN C$ = CHR$(ASC(C$) - (ASC("a")-ASC("A")))
1720 PRINT C$;
1730 RETURN
1740 ’ ---------- Routine to clear command area
1750 NRLINES% = 0
1760 CALL SCROLLUP (NRLINES%, ULR%(3), ULC%(3), LRR%(3), LRC%(3), ATTR%(3))
1770 LOCATE 23, 1
1780 RETURN
1790 ’ ---------- reset both windows
1800 KEY OFF: CLS
1810 LOCATE 11, 1:  PRINT STRING$(80,CHR$(205))
1820 LOCATE 22, 1:  PRINT STRING$(80,CHR$(205))
1830 FOR W = 1 TO 2: ATTR%(W) = 7: GOSUB 1540: NEXT W
1840 ATTR%(3) = 7: GOSUB 1740
1850 W = 1  ’ default is top window
1860 RETURN
```

IBM Images, continued...

The program is clear, and instructions for its use are included in the comments. The commands are single letters, which are interpreted immediately without need of an ENTER key depression. When parameters are required, the program prompts for them; if letters, they are taken immediately, and if numbers, an ENTER is required.

When invoked, the program clears the screen, divides it into three windows, and fills the two upper windows with text. The bottom window is the command area in which the program prompts are displayed. The routines SCROLLUP and SCROLLDN are used in the program whenever the windows are to be scrolled, cleared, or filled. The reset command (R) can be used to restore the program to its initial state in case things go awry (they can).

The section of the program in lines 1200 to 1250 is the really tricky part in which the assembly language routine is loaded into memory. The first step (1210) is to specify how much memory Basic will use for its workspace. This is needed to reserve memory space outside the Basic workspace area for the assembly language program. If you are using Basic (as opposed to BasicA), the number 32000 should leave plenty of space. BasicA is bigger, so it might be necessary to specify a smaller number when it is used. In any case, the workspace size is a number which should be adjusted for your exact configuration. The second step is to load the program using BLOAD. The file created by the BSAVE command contains specific memory addresses, so line 1220 works without any additional parameters.

Lines 1230 through 1250 establish the values Basic will need to call the assembly language routines. What you have to do is specify the precise memory address for each routine loaded. Addresses for the 8088 processor have two components, the segment address and the offset within the segment. In Basic, the DEF SEG statement is used to establish the segment address, and the names of the subroutines are assigned the offset values. In this case, SCROLLUP is at location 0 in segment &H1FFC, while SCROLLDN is at location &HE. (Note: The &H is the Basic convention to denote a hexadecimal number.)

In this program the DEF SEG statement has been used once, so its "scope" is the entire program. That means that Basic statements like CALL, POKE, PEEK, and others that specify an offset against the current segment address are affected. This is not a problem for DEMO, but care must be exercised if a program of yours uses such statements to be sure that the correct address is being specified in each case. This might imply a DEF SEG before every such statement.

The two scroll routines require six arguments, of which four are the coordinates that define the position of the window on the display. Each coordinate is a pair, one to specify the row

A Note on Diskettes

I have previously written about my great success with Radio Shack diskettes, even when used in double sided drives. I recently bought two boxes (this is diskette sale time, an annual affair it seems) and I ran into some problems.

I was immediately struck by the change in packaging, not so much for the form/factor as for the bold words on the front of the box: Single-Sided Diskettes. Even though all the Radio Shack computers use only single sided drives, they had never made a big deal about the diskettes before. I was a little hesitant, because I thought the media had changed in some way and was really only usable on one side. I tried the new box of diskettes within days.

Of the six disks I tried, only two formatted without error. Of the other four, two never made it past the formatter program and the other two both had bad tracks allocated. This problem occurred with both single and double sided formatting.

I called my local store manager, who was very nice about the whole thing and offered to take everything back. It turns out that she had some boxes of the previous batch of disks, so I was able to trade back for the ones I have been using all along. I have no complaints about the way the problem was handled at the store.

I suspected some major manufacturing change because an examination of one of the new diskettes next to the older one revealed a half dozen physical differences. I called Fort Worth and talked with Bob MacQuigg, Tandy's buyer for diskettes. I related my story to him, along with my suspicions, and gave him a description of the differences.

His response was surprise, and he told me straight out that there had been no change in vendor or formulation of the product. He said there had been no reports of field problems, but more to the point that no internal problems had been reported. All the Radio Shack software is placed on these same diskettes, and Bob felt that any problem with the media would have been caught inside.

Bob made one very interesting point. He said that Tandy had "overbuilt" when it came to diskettes because of the many different brands of disk drives used by Radio Shack computers. In order to avoid problems caused by minor variations in the drives, Tandy buys diskettes able to perform in all the drives without error. This might explain why I have had no problem using them with my double sided drives.

The problem may well have been localized to the box of diskettes I picked up, or even to that lot from the vendor. Under ordinary circumstances I would have let the matter rest since, after all, my problem was solved. However, I have rated Radio Shack diskettes so highly in the past that I felt compelled to tell this story.

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CIRCLE 245 ON READER SERVICE CARD

Listing 2.

```
 1                        page 54,130
 2                        ; SCROLL UP/DN - Interface for BASIC to BIOS Scrolling Routines
 3                        ;
 4                        ; Author:   Will Fastie
 5                        ; Source:   SCROLL.asm
 6                        ; Created:  15 Jan 83
 7                        ; Edited:   02 Feb 83  1520
 8                        ;
 9                        ; BASIC calling sequence:
10                        ;
11                        ;       CALL SCROLLUP (NRLINES%, ULR%, ULC%, LRR%, LRC%, ATTR%)
12                        ;       CALL SCROLLDN (NRLINES%, ULR%, ULC%, LRR%, LRC%, ATTR%)
13                        ;
14                        ; where
15                        ;       NRLINES  - the number of lines to scroll.  If 0, clear entire window.
16                        ;       ULR, ULC - the "R"ow and "C"olumn of the upper left corner of the
17                        ;                  window to be scrolled.
18                        ;       LRR, LRC - the "R"ow and "C"olumn of the lower right corner of the
19                        ;                  window to be scrolled.
20                        ;       ATTR     - the display attribute to be used on the blank lines
21                        ;                  scrolled into the window.
22                        ; Notes
23                        ; -----
24                        ; 1.  All arguments passed to these two routines must be declared as BASIC
25                        ;     integers.  The simplest way to do this is to use the % suffix.
26                        ; 2.  The row values range from 0 to 24.  Column values range from 0 to 79.
27                        ; 3.  See article text for description of legal ATTR% values.
28                        ;
29                        ; When a BASIC CALL is executed, BASIC's work segment offset of each argument
30                        ; is pushed onto the stack.  The arguments are pushed onto the stack left to
31                        ; right, that is, in the order they are written on the page.  This means that
32                        ; the last argument's address is on top of the stack.  The following structure
33                        ; shows the organization of the stack after the call.
34                        ; (I use the suffix "x" to denote "address of," out of long habit.)
35                        ;
36                        stack   struc
37   0000  ????????               retx    dd (?)          ; caller's return address  (<--- SP)
38   0004  ????                   bptemp  dw (?)          ; caller's frame pointer
39   0006  ????                   attrx   dw (?)          ; attribute argument
40   0008  ????                   lrcx    dw (?)          ; coordinate of lower right corner of window
41   000A  ????                   lrrx    dw (?)          ;
42   000C  ????                   ulcx    dw (?)          ; coordinate of upper left corner of window
43   000E  ????                   ulrx    dw (?)          ;
44   0010  ????                   nrx     dw (?)          ; number of lines to scroll
45   0012                 stack   ends
46   = 000C               frmsz   equ     (offset nrx - offset attrx) + 2        ; frame size
47                        ;
48   0000                 cseg    segment
49                                assume cs:cseg
```

position and one to specify the column. The coordinates are stored in arrays named UL (upper left) and LR (lower right). The suffixed letter is either R (for row) or C (by now, you should have the idea). The first argument to the routines is the number of lines to be scrolled, and for which a value of zero means that the window is to be cleared. The last argument specifies the display attribute to be used on the blank lines that are scrolled in.

The rest of the program should be self-explanatory. Note that SCROLLUP is used as a way to clear window 3 (the command area).

The Subroutine

I know what you are thinking: "Hey, Will, where'd that subroutine in SCROLL.ABS come from anyway?" Fair question. The answer, unfortunately, is ridiculously complex.

The first part isn't too bad. Listing 2 shows the assembly language routines SCROLLUP and SCROLLDN. Again, I think it is well-documented, so I won't overdo the explanation here. I'll make two points. First, the "struc" declaration beginning on line 36 defines a set of names that are used to reference values on the stack. I defined this structure so I wouldn't have to remember the actual numeric offset of each value; instead, the stack is referenced by expressions such as

`[BP].NRX`

which is the address of the number of lines argument. This simply leads to greater clarity. Second, both scroll routines are exactly alike with the exception of the function code for the BIOS

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Listing 2, continued.

```
                                  public  scrollup, scrolldn
                              ;----------
      0000                    scrollup proc   far
      0000  55                        push    bp              ; save caller's frame pointer
      0001  8B EC                     mov     bp,sp           ; set up our frame pointer...
      0003  E8 001C R                 call    setup           ; get arguments into registers
      0006  B4 06                     mov     ah,6            ; function code for scroll up
      0008  CD 10                     int     10H             ; video i/o
      000A  5D                        pop     bp              ; restore caller's frame pointer
      000B  CA 000C                   ret     frmsz           ; six arguments to remove
      000E                    scrollup endp
                              ;----------
      000E                    scrolldn proc   far
      000E  55                        push    bp              ; save caller's frame pointer
      000F  8B EC                     mov     bp,sp           ; set up our frame pointer...
      0011- E8 001C R                 call    setup           ; get arguments into registers
      0014  B4 07                     mov     ah,7            ; function code for scroll down
      0016  CD 10                     int     10H             ; video i/o
      0018  5D                        pop     bp              ; restore caller's frame pointer
      0019  CA 000C                   ret     frmsz           ; six arguments to remove
      001C                    scrolldn endp
                              ;----------
                              ; This routine sets up the registers for the INT call.  It can be used by
                              ; both SCROLL routines since the calling sequences differ only by function
                              ; code (AH).
                              ;
                              ; Since all the argument values are less than 256, we can cheat a little bit
                              ; by loading only the low-order byte of each word.
                              ;
      001C                    setup   proc    near
      001C  8B 76 10                  mov     si,[bp].nrx     ; get address of NRLINES argument
      001F  8A 04                     mov     al,[si]         ; get low order byte of value
      0021  8B 76 0E                  mov     si,[bp].ulrx    ; etc., for all arguments...
      0024  8A 2C                     mov     ch,[si]
      0026  8B 76 0C                  mov     si,[bp].ulcx
      0029  8A 0C                     mov     cl,[si]
      002B  8B 76 0A                  mov     si,[bp].lrrx
      002E  8A 34                     mov     dh,[si]
      0030  8B 76 08                  mov     si,[bp].lrcx
      0033  8A 14                     mov     dl,[si]
      0035  8B 76 06                  mov     si,[bp].attrx
      0038  8A 3C                     mov     bh,[si]
      003A  C3                        ret
      003B                    setup   endp
                              ;
      003B                    cseg    ends
                                      end
```

call. I have therefore written a common routine that is called by both scroll routines and whose function it is to set up the registers for the call. The common routine, cleverly named "setup," does use one trick: since the value passed is always less than 256, only the low-order byte of each integer is used.

In anticipation of testing the program with a compiled version of the DEMO program, I declared the names SCROLLUP and SCROLLDN "public," which simply means that LINK, the DOS linker, will "see" the names when it reads SCROLL.OBJ, the object file. I used the same names in DEMO, and for the same reason. More on that later.

The Surgery

So now we have a program in Basic, and a routine in assembly language. How do we get them together? All my screaming and cursing did not help. The manuals did, however, and I must admit they were very clear and complete. Version 1.1 of the Basic manual includes explicit instructions for this entire process, including examples.

Nonetheless, it is a very painful process to connect an *interpreted* Basic program with assembly language routines. The *compiled* Basic program is simplicity itself; the linker does all the work. All that the linker does for the compiled program must be done by hand for the interpreted version.

The first step is to assemble the program and run LINK to produce a .EXE file. Use the /HIGH switch to force the program to reside in the high end of memory. Do not link the module with any libraries, and do not attempt to actually execute the result—you will be disappointed. A record of the process is apple discount software

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```
dir
SCROLL   ASM      3250   2-02-83   4:13p
        1 File(s)
C>a:masm scroll,,,;
The IBM Personal Computer MACRO Assembler
Version 1.00 (C)Copyright IBM Corp 1981


Warning Severe
Errors  Errors
0       0

C>dir
SCROLL   ASM      3250   2-02-83   4:13p
SCROLL   OBJ       151   2-02-83   7:41p
SCROLL   LST      5906   2-02-83   7:41p
SCROLL   CRF       306   2-02-83   7:41p
        4 File(s)
C>a:link scroll/high;

IBM Personal Computer Linker
Version 1.10 (C)Copyright IBM Corp 1982

Warning: No STACK segment

There was 1 error detected.

C>dir
SCROLL   ASM      3250   2-02-83   4:13p
SCROLL   OBJ       151   2-02-83   7:41p
SCROLL   LST      5906   2-02-83   7:41p
SCROLL   CRF       306   2-02-83   7:41p
SCROLL   EXE     · 640   2-02-83   7:41p
        5 File(s)
```

Listing 3.

shown in Listing 3.

Step two involves loading the program into memory with the debugger while the Basic interpreter is also resident in memory. This process is shown in Listing 4. The debugger is invoked and Basic is loaded. The registers are examined. The file SCROLL.EXE is named and then loaded into memory. The registers are then examined to see where in memory the program is. Note the contents of CS (&H1FFC) and IP (0), which are the same as the values used in DEMO. Registers SS, CS, and IP are restored to their earlier values, and the Basic interpreter is then executed by giving the DEBUG command G, for go.

When I did this, Basic emitted an error message, "Direct statement in file." At first I was worried about this, but after I failed in my attempts to make the error go away, I decided to ignore it. I have not yet discovered why this happens, nor was it mentioned in the manual. It is possible that I should have explicitly defined the Basic workspace in the DOS command line (with the /M: switch), but because I have 128K of main memory, the assembly language routine ends up very high in memory, well beyond the limits of the biggest possible Basic workspace. Once I ignored the message, the rest of the procedure was uneventful.

Listing 4.

```
C>a:debug a:basica.com
-r
AX=0000  BX=0000  CX=4180  DX=0000  SP=FFF0  BP=0000  SI=0000  DI=0000
DS=04DB  ES=04DB  SS=04DB  CS=04DB  IP=0100   NV UP DI PL NZ NA PO NC
04DB:0100 E9E43E        JMP     3FE7
-n scroll.exe
-l
-r
AX=0000  BX=0000  CX=003B  DX=0000  SP=0000  BP=0000  SI=0000  DI=0000
DS=04DB  ES=04DB  SS=1FFC  CS=1FFC  IP=0000   NV UP DI PL NZ NA PO NC
1FFC:0000 55            PUSH    BP
-r ss
SS 1FFC
:4db
-r cs
CS 1FFC
:4db
-r ip
IP 0000
:100
-g
```

When the command Go is given, Basic gets control. And once in Basic, it is possible to write any portion of memory to a disk file with the BSAVE command. The exact sequence of commands I needed was

```
DEF SEG = &H1FFC
BSAVE ''SCROLL.ABS'', 0,
&H3B
```

These commands require information from the *second* set of registers shown in Listing 4. The value for the DEF SEG statement comes from the CS register. The offset 0 from the BSAVE command comes from the IP register, and the length &H3B comes from the CX register.

And bingo! The file SCROLL.ABS has the subroutine in a format that can be loaded by the BLOAD command, just as is done by the DEMO program. Only one thing remains, and that is to figure out how to get out of Basic, out of DEBUG, and back to DOS. Say SYSTEM to leave Basic, which in this case takes you not to DOS but to the debugger, which will report "Program terminated normally." Then use the Q command to leave the debugger.

And don't forget, the values shown in these listings may not be for you. You must do the whole process yourself and get numbers that fit your system.

The Catch

Ah yes. The Catch.

The catch is that you must have the assembler to develop and implement such routines, unless you are a master at encoding instructions into hexadecimal notation and placing them into memory by hand. The assembler isn't very much, only $100 from your dealer, so it might be a practical addition to your software library if you have many things like this to do.

If you are interested in these routines but don't have the assembler, you can still manage. It will just take more manual labor. What you have to do is use the debugger to enter the hexadecimal values into memory, and then write the section of memory to disk. You can then use a procedure similar to the one I have outlined to get the program loaded with your Basic program. Another possibility is to take the hexadecimal values and put them into DATA statements in your Basic program. You then have to write a short routine that will POKE them into some appropriate place in memory.

You must watch one thing, though. Lines 55 and 65 of Listing 2 are CALLs to the setup routine. On the listing, they are shown as if they had been encoded as E8 001C. However, you must not use the 001C value as is. It is the actual offset in the program of the label SETUP.

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If you look at lines 79 and 80 you will see that value in the leftmost column. It is the linker which will fill in the actual value that is needed, which is the distance between the E8 instruction and the SETUP routine.

If the SCROLL.EXE program is in memory with the debugger, the unassemble (U) command can be used to display the contents of memory in assembly language terms, and the actual offset can be seen. The actual offsets are 22 for line 55 and 8 for line 65. Also, the offsets are stored low byte first, so line 55 should have a contents of E8 16 00 and line 65 should read E8 08 00. Note that I have shown the low-order value of these numbers first, because the 8088 expects them to be stored in memory that way.

What I craved during all this was a program that would take the .EXE file and convert it into a file to be BLOADed. Except for time, I would have done it. It is the one thing that would have eliminated all these crazy steps.

The Performance

The DEMO program demonstrates not only the scrolling features, but how tremendously fast they are. It is simply not possible to see any scrolling at all; things just happen. I was not prepared for quite that much speed, and it actually caused me to change the program. At first, I had cleared the command area by writing blanks into it. This could be seen to be slow, so I defined the third window and had the scroll routine clear the area.

It is nice that the performance is so good. It made me mad, though, because the BIOS should be capable of similar speeds for writing to the display. As I have mentioned before, that process is painfully slow, a design flaw in the BIOS. The scrolling routines clearly show how quick the machine can be, particularly if you realize that the scrolling operation requires the movement of each character from one display memory location to another. Well, maybe in PC II, eh?

The Bug

Leave it to me to find a bug wandering around. You can see the effect if you have DEMO running. Give the command S followed by U or D, and a number 10 or greater. The screen goes bonkers (the best word I could come up with to describe what happens).

It appears that BIOS does not check to see if the requested number of lines is bigger than the size of the window. When it is, the scroll is not right. I call this a bug because there is nothing documented to indicate that such a value is illegal and because the routine should handle all cases anyway.

The Irritation

One thing bugged me. I am used to using row and column coordinates that start at 1 because these are expected by the LOCATE statement. The BIOS routines want values that start at 0. This was a great hassle until I spent a few minutes marking a listing of the program and getting everything just so. You can see the problem in line 1580 of DEMO.

I lay the blame for this at the doorstep of Basic, because it is out of step with everything else. In BIOS, everything seems to start from 0, and therefore other languages tend to support those conventions. In defense of Basic, I must admit that human beings start from 1, so it is more natural.

The Result

The final program suite is useful for experimenting with windows. It is easily modified to support more windows; the set of routines forms a kernel around which a larger, more complex screen management program can be developed.

The DEMO program also includes several useful programming techniques. One is the use of the INSTR function to decode the command letter, and the subsequent use of the value to control an ON . . .GOSUB statement. Another is the statement that converts all input characters to upper case. It is interesting because it does not use "magic" numbers, and the only piece of information assumed is that the ASCII value for the letter *a* is numerically greater than that for the letter *A*.

Other routines in BIOS, and those that you might write yourself, can be interfaced to Basic using the techniques illustrated here. I hope all this information has been helpful. ☐

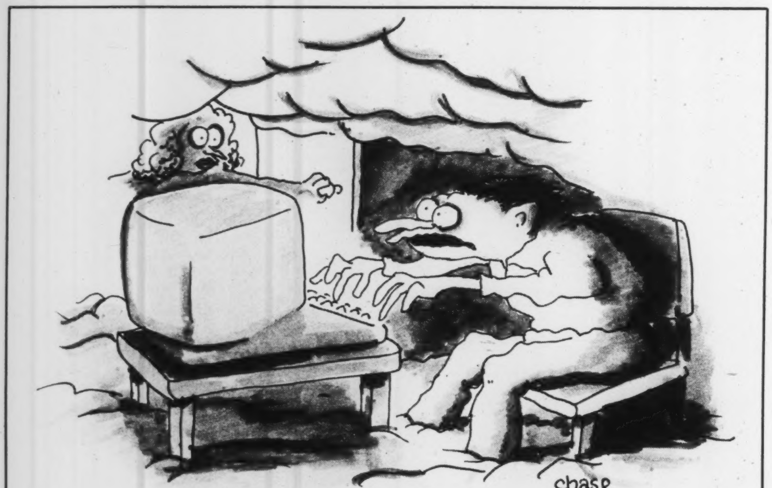
Display Attributes

The DEMO program is capable of changing the display attribute used by the scroll routines. The following attribute values may be used on the monochrome display. With the exception of 1, they also work for the color displays. You can use the program to experiment with others.

0	No display (black screen)
1	Underline this character
7	Normal display (white on black)
112	Reverse Video (black on white)
119	No display (white screen)

To these values you can add either 8, to make the characters bold, or 128, to make them blink, or both. For example, 143 (7 + 8 + 128) makes blinking, bold white characters on a black background.

The data which are filled into the windows will not have the same attribute, because Basic uses information from COLOR statements when it writes to the display. You could easily modify DEMO to decode the attribute and make the appropriate statement of COLOR before writing anything to the screen.



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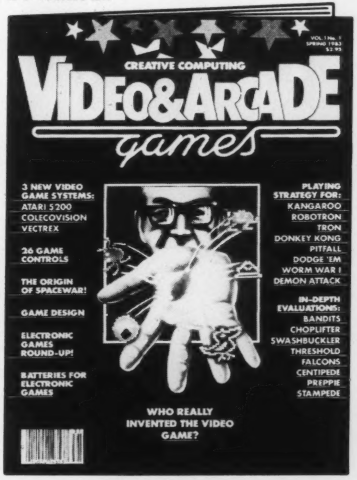
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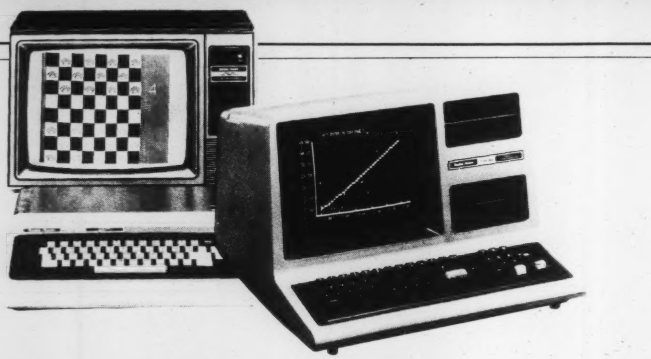


rings...trs-80 strings...trs-8

Stephen B. Gray

As we pass the fifty-first planet in the solar system known only as TRS-80, we see ahead of us a cassette magazine for the Color Computer, *CLOAD* magazine on disk, three books recommended for the Color Computer, how to make sure a program is SAVEd to disk, flippies, a school newsletter, and short program that's a screen editor.

Cassette Magazine for Color Computer

The publishers of *CLOAD* magazine (for the TRS-80 Model I and III) announced a cassette magazine for the Color Computer with an ad in these pages back in June 1981.

Now that I've had Extended Color Basic with high-resolution graphics added to my Color Computer, I can finally review *Chromasette* Magazine (Box 1087, Santa Barbara, CA 93102). A subscription is $45 a year for 12 issues, which have six to eight programs on each cassette. Six issues are $25; a sample one is $5.

Chromasette is very much like *CLOAD*, with a cassette wrapped in an accompanying letter that lists the programs, gives their PMODE and PCLEAR values (if needed), their locations on tape, several paragraphs of documentation about each (sometimes suggesting program alterations that change or improve the results), a variety of information about the Color Computer and some of the hardware and software available for it, and some ads.

Each issue, as with *CLOAD*, starts with a cover, just like a regular magazine. The first issue, dated July 1981, was described in March 1982 (p. 36). Briefly, the first cover shows the *Chromasette* name in script, moves it left, right, up, down, etc. The listing includes seven strings of 192 characters each, according to the letter, which goes into nice detail on how the program was written.

All programs are recorded twice, and are written for Extended Color Basic; 16K is required because many programs are long. Back copies of all issues are available; they'll send you a list on request.

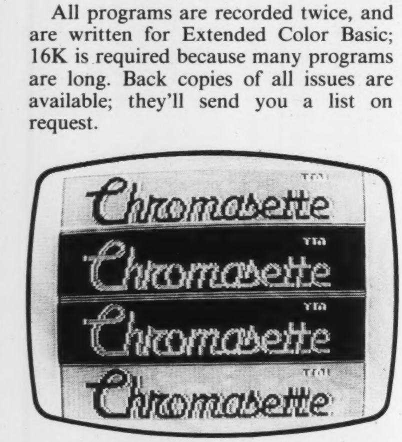


Figure 1. Chromasette's *first cover makes use of the cassette-magazine's logo, moving it all over the screen, in duplicate and quadruplicate, and in various colors.*

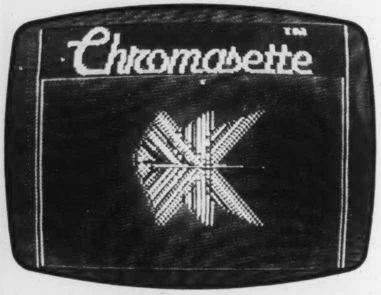


Figure 2. The second cover of Chromasette *(August 1981) is a demonstration of the DRAW command, using the Scale, Color, and Angle modes, and the No-Update option.*

Later Chromasette Issues

Subsequent issues of *Chromassette* magazine contain a version of Lunar Lander, tutorials on debugging programs, a high-precision calculator (to 900 places), "repeat-the-musical-pattern" game, Motorcycle Jump, Morse-code tutor, typing tutor, disassembler, Rubik's Cube, String Art, disk editor, Star Map (with constellations), Equations (matrix manipulation), Display Demo (28 display routines), Tape Inventory (catalogs tape programs), disk cataloger, Astromines, Pong (the original videogame), Life, Curve Fit, plus many other games, utilities, educational programs, and some great color covers.

Incidentally, in just little more than a year, *Chromasette* overtook *CLOAD*, and has more subscribers than the parent; by the end of this year, it may have twice as many, according to editor Dave, who also says his crew is working on a disk version of *Chromasette.* (Dave signs only his first name to the *CLOAD* and *Chromasette* letters, in keeping with their informal air.)

CLOAD on Disk

Speaking of disk, *CLOAD* has been available on disk since last October, at $95 a year for 12 issues (the cassette version is $50 a year), $55 for six issues, and $11 for a single copy (Box 1448, Santa Barbara, CA 93102).

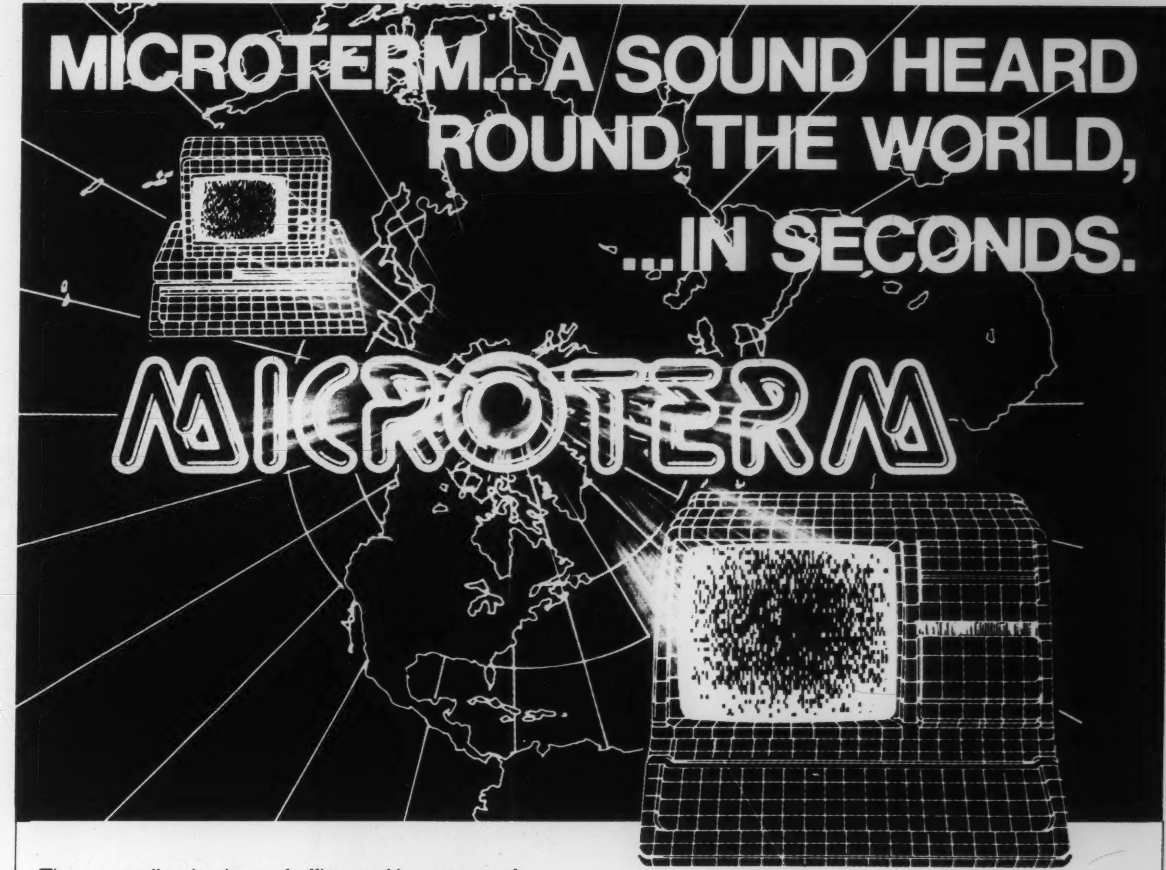
If you've gotten used to the convenience and speed of disk, you may be willing to pay the extra for *CLOAD* on disk. In much less time than it takes just to find the program you want on tape, you can have the disk version up and running.

Just get into Basic, key in

```
RUN "AWAY"
```

and the program menu is displayed. Any time you want to get back to the menu, just a BREAK and

```
RUN "AWAY"
```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will recall it, unless the program is in machine language, in which case you'll have to hit the reset button and then get back into Basic again. That's all there is to it.

The Lone Survivor

Of the several TRS-80 Model I cassette magazines that were started over the past few years, only *CLOAD* is still in business. The December 1982 issue (the most recent I have on hand at this writing) is the 58th, and runs on Models I and III, either cassette or disk systems.

CLOAD seems to contain a little higher percentage of games than several years ago. The last three issues of 1982 contain 23 programs, of which three are covers and nine are games. (Two of the latter, Swarm and Cave Raider, seem impossible to beat.) The others include Bond (financial), Air Nav (flight planning for pilots), Disk Copy (for one-disk systems), Menu (reads the disk directory, displays it in menu form), Loan Amortization, Logic Trainer (teaches logic circuits), Planets (shows relative positions for a given date), and Net Worth (computes yours).

For a good mix of games, utilities and practical programs, try a sample copy of *CLOAD* or *Chromasette,* or a six-month subscription. It's well worth the money.

Three Books for the Color Computer

Three fine books for the Color Computer were recently issued by Reston Publishing Co., part of Prentice-Hall. Two are on graphics, and the third gives an idea of what can be done with this computer.

Don Inman's *TRS-80 Color Computer Graphics* (hardcover $20.95, paperback $14.95) concentrates on the 16K Extended Color Basic graphics. It follows pretty much the same sequence as the Radio Shack manual, but much more clearly, with many helpful diagrams.

Once you have fully understood this book, you may want to move on to *Assembly Language Graphics for the TRS-80 Color Computer,* by Don Inman and Kurt Inman, which shows how assembly language can be used to write programs that would be difficult or impossible to write in Basic. Learning is simplified by the use of sound and graphics programs rather than a mathematical approach, in a book written for hands-on use.

The beginner who has read Radio Shack's *Getting Started With Color Basic,* but doesn't know where to go from there, can find a variety of applications in *TRS-80 Programs and Applications for the Color Computer,* by Alfred Baker. Almost every chapter contains games, which range from *Home Inventory* to a color version of Mastermind, from a checkbook program to Spaceship. All program lines are very nicely annotated.

If not for you, then these three would make a very nice gift for anyone who has gotten a Color Computer and wants to learn how to make real use of it.

Did It Write to Disk OK?

If you have a disk system, perhaps you just assume everything is working fine when you do a SAVE, and don't bother to check. But if you have ever had the experience of trying to LOAD a disk program, only to find that part or all of it didn't get recorded, or somehow was merged partially with another program, then you may want to check every SAVE with a LOAD.

(Most of these problems occur when your disk drive is out of alignment, and your first inkling of the misalignment is likely to be a bad SAVE. But even after you get the drive repaired, you may find, as I did, that it is a good idea to do a read after a write, meaning a checkout LOAD after a SAVE.)

One way of verifying a SAVE is to clear the screen and then do a LOAD, as some books on the TRS-80 suggest. But if you didn't do a PRINT beforehand, you may lose the entire program. This is one reason for always printing your program before doing a SAVE, especially if it's late and you're a little tired; it's amazing how many wrong keys get pressed after midnight. (Assuming you have a printer, or course; one of my main uses for a printer is to put every program of *Scripsit* text on a readable medium before a SAVE. If this seems like a great deal of work, consider the large number of backup files that have to be made constantly in business applications, just to make sure nothing is wiped out for keeps.)

But even if you did print the program, having to enter it all over again by hand, because the SAVE went wrong, isn't much fun. There is a simple way to look at the SAVEd copy without first erasing the original from the screen.

If you use *Scripsit,* after you have done a

```
S PROG23
```

for example, just do a load-and-chain with

```
L,C PROG23
```

and the SAVEd text will be displayed right after the original. If there is anything wrong with the second text on the screen, you still have the original text.

Checking a SAVEd Basic Program

Reading back a Basic program after you have SAVEd it to disk is a little more complicated than checking a *Scripsit* text, but it can be well worth the time, especially if you have a long program and suspect there is something wrong with your disk drive. First you write the program

```
10 CLS
20 X=RND(128)-1
30 Y=RND(48)-1
40 SET(X,Y)
50 GOTO 20
```

and SAVE it in ASCII format with, for example,

```
SAVE "PG47",A
```

rather than in the usual compressed format.

Then renumber the program on the screen with, for example,

```
NAME 100,10,20
```

which will renumber all the lines starting with line 10, change the first line number to 100, increment the subsequent lines by 20, and renumber line references within the program:

```
100 CLS
120 X=RND(128)-1
140 Y=RND(48)-1
160 SET(X,Y)
180 GOTO 120
```

Now merge this program on the screen with the original program on disk, using

```
MERGE "PG47"
```

(which requires that the original program be stored on disk in ASCII format) and the display turns into

```
10 CLS
20 X=RND(128)-1
30 Y=RND(48)-1
40 SET(X,Y)
50 GOTO 20
100 CLS
120 X=RND(128)-1
140 Y=RND(48)-1
160 SET(X,Y)
180 GOTO 120
```

That may seem like more work than it's worth, but if you have ever wiped out a long program you spent many hours on, you will find it well worth the extra time spent.

Of course, the renumbered program should have line numbers far above the line numbers of the original program to ensure that there is no interference between them. Otherwise some lines from the renumbered program might be inserted between lines in the original program, or worse, replace those lines.

This method for checking a Basic SAVE assumes that you are using TRSDOS, which has both renumbering

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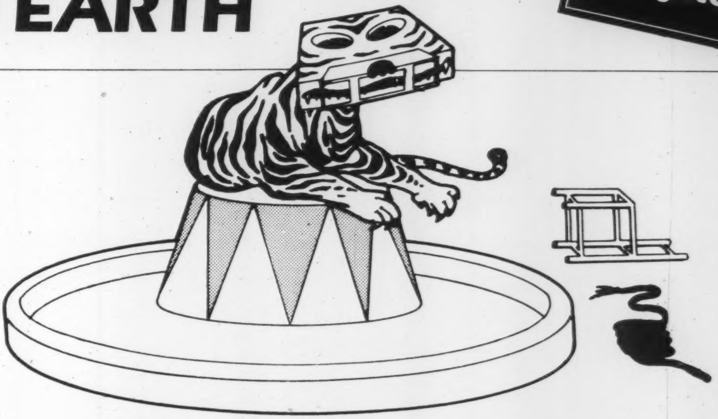

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The Fine Print: All issues from July 1981 available — ask for list. Programs are for the Extended BASIC model and occasionally for disks.

Chromasette MAGAZINE

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and merge routines. Not all DOS programs have both.

Flippies

What's a flippy? A double-sided floppy, that's what—a floppy disk you can turn over and use on both sides. Who makes them? Well, for one, Omni Resources Corp. (4 Oak Pond Ave., Millbury, MA 01527). For another, Nashua Corp.'s Computer Products Division (Nashua, NH 03061).

There's some controversy about the wisdom of using the both sides of a floppy disk, mostly coming from companies that make floppies, but not flippies. One such company spoke only of the "contamination factor." Another told me, "When you turn the disk in the opposite direction, you're liable to dislodge dust and dirt particles that have gotten nicely embedded in the felt pad that presses against the disk, and cause hard errors." But they had to agree that this isn't likely to happen if you perform standard preventive maintenance, changing the pad and cleaning the head regularly.

Verbatim did have a $5\frac{1}{4}$" flippy, but dropped it from their line because of low customer demand. "Most people weren't using the flippies, except for law offices, where they have a lot of text to store," a Verbatim salesman told me.

Omni Resources, which runs ads in these pages, has no problems with spinning floppies in both directions. When I asked marketing manager Paul Johnson about the story that reversing the direction of a floppy can bring out dirt, he said they had tested what Omni calls "Flip/Floppy reversible" disks for long periods, reversing them over and over, and found no significant excess wear over normal disk wear.

Omni has a network of dealers in the U.S. and Canada. If you can't find one locally, you can get reversible $5\frac{1}{4}$" Omni disks at $39.90 for ten, plus $2 for shipping and handling, from Archive (152 Boston Turnpike, Shrewsbury, MA 01545). Remember to specify what type of machine and disk drive you're using.

Can't you use both sides of any floppy? Yes, but not without some alterations. You have to cut a write-protect notch in the opposite edge of the disk jacket, otherwise you will never be able to write on the second side. Also, you must cut another index hole thru the jacket, so the photocell can detect the light from the LED for sector timing when the disk is turned over. The Omni Flip/Floppies come with two sets of notches and holes.

The head of a software company gave me the details, "You can take floppies and notch them yourself. If you don't write on the disks, you needn't make the notch. You can use a paper punch that makes a round hole for the write-protect notch; it's better for strain relief than the dies used commercially, because the circle doesn't crimp the cardboard as much as the die."

As for the index hole, he said, "Use the paper punch, open the pocket, and punch holes in the top and bottom. Don't touch the disk itself."

The main problem with using the other side of single-sided disks is that those other sides aren't certified as being error-free. So you can't be sure they will write data properly, and read it all back. Omni certifies its Flip/Floppy disks to be 100-percent error-free on both sides.

INFO LINE
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"But your ad said you needed someone who knows basic string handling!"

For about 1.7 times the cost of a single-sided disk, you can double the storage capacity to each disk by using a Flip/Floppy, and cut your disk-storage space requirements in half. (Omni single-sided double-density disks for the Model III TRS-80 are $23.90 for ten.)

School Newsletter

For several years, a computer newsletter was published for teachers in the Cleveland public school system, which had started to use the TRS-80 computers throughout the secondary schools, and for the educational computer organizations in the area.

Wallace P. Havenhill, who edited the newsletter, tried to publish it monthly, but had to suspend it due to lack of time. He hoped to start it up again, last time we talked.

The first issue, published in September 1979, provided three graphics programs (graphing functions, drawing line segments, and line graphs) with program lines explained; a merge program; and five pages of basic TRS-80 tutorial (with simple programs for hands-on use).

Later issues included information about computer courses given by local Radio Shack stores, tutorials on TRS-80 graphics, a glossary of computer terms, and details of an upcoming computer programming contest.

In his most recent letter, the newsletter editor noted that although the schools had several dozen of the Model I (connected to TV sets with 23" screens) and had ordered a dozen of the Model III, he suspected that "the Color Computer will be a better general purpose educational computer than the Model III or Model I." (At the time of the first newsletter, he was a math department chairman in one of the junior highs, but as the number of computers grew, he was reassigned "to train teachers to use computers, to develop educational software, and to advise the subject supervisor on what hardware is needed or best suits our needs," as he put it.)

Hopefully the newsletter was (or will be) resumed but, having published the first personal computer newsletter in the world (from 1966 to 1977), I know all too well the problems of trying to find time, as well as money.

Short Program #38: Screen Editor

This letter with a very clever program came some months ago from Alex Lewin of North Haven, CT:

"I am twelve years old, and have a TRS-80 Model I Level-II with 16K RAM. I was once trying to solve a very complex puzzle on the computer, but I gave it up (it would have taken about 30 hours). Instead, I made a screen editor and solved it easily.

"To operate this program, type it in and RUN it. The cursor can be moved, without harming whatever it passes over, by using an arrow in conjunction with SHIFT. Things may be typed as normally done. Pressing CLEAR will clear everything below the cursor. You may erase single characters by using SPACE or the left-arrow.

"The T in the lower-right corner indicates text mode. To move into graphics mode, press SHIFT G. Typing in three-number sequences will produce the corresponding character. Graphics mode may be exited by pressing SHIFT T or an impossible character (such as 783)."

Line 40 puts a T in the lower-right corner of the screen. Lines 50-60 cause the screen to display the character corresponding to whatever key is pressed, unless the character is SHIFT G (g or ASCII code 103). If it is, then the program moves to line 70, which puts a G in the lower-right corner.

Line 80 counts three key depressions, and lines 100-110 turn the three numbers (if they are between 128 and 191) into a graphics character and display it on the screen. Unless the user presses SHIFT T (t or ASCII code 116), in which case line 100 moves the program to line 40.

As written, this program, which does a great deal for such a short one, can create text or graphics on the screen but can neither save them nor edit previously written programs. So I wrote Alex to ask what he used the program for. He replied:

"I used the program to solve

DONALD
GERALD
ROBERT

where D=5, and each letter represents one digit (no two letters are the same digit). What I did was this: I set up a chart like this:

5onal5
geral5
robert

	greater-than	less-than	odd/even
=0 d			
1 o			
2 n			
3 a			
4 l			
d=5 g			
6 e			
7 r			
8 b			
9 t			

and when I found something out about a letter, I replaced it in the problem with the approprate digit."

Can you solve the DONALD+GERALD=ROBERT problem with the screen editor? ☐

```
10 ON ERROR GOTO 140
20 DEFINT A-V: DEFSTR W-Z: CLS
30 PRINT CHR$(14);
40 POKE 16383,84 '* T INDICATOR
50 Z=INKEY$: IF Z="" THEN 50
60 IF ASC(Z)<>103 PRINT Z;: GOTO 50
70 POKE 16383,71 '* G INDICATOR
80 Z="": FOR J=1 TO 3
90 Y=INKEY$: IF Y="" THEN 90
100 IF ASC(Y)=116 THEN 40
110 Z=Z+Y: NEXT J
120 A=VAL(Z): PRINT CHR$(A);
130 GOTO 70
140 RESUME 40
```

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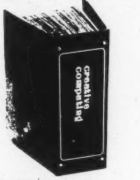

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2010: Odyssey 2, by Arthur C. Clarke. DelRey/Ballantine, New York. 291 pp., hardcover, $14.95. 1982.

When asked if and when he would ever write a sequel to *2001: A Space Odyssey*, Arthur Clarke spent the better part of a decade explaining that such an undertaking would be utterly impossible. He was right, of course, and his reasons for changing his mind are nearly beyond my capability to fathom.

Nonetheless, we have lately been presented with *2010: Odyssey 2*, and sheer curiosity, I should think, to some degree accounts for its having spent two months on the *Times* Best Seller list.

Having been a fan of Arthur C. Clarke and *2001* since childhood, I was not about to let the pusillanimous attempt sneak past me. I knew I would be disappointed, but somehow held out the vague hope that the author would manage to do the impossible: write a sequel to a book for which no sequel can be written.

When they don't work, sequels tend to leave an especially bitter taste on the palate. For in the worst case, they manage not only to disappoint, but to compromise their very namesakes, and in the process undermine our estimation of the original work, the supposed inspiration of the sequel.

Extremely unfortunately, I found this to be much the case with *2010: Odyssey 2*. While I would agree that the job of writing a sequel to *2001* is nearly impossible to even contemplate, I am sure that many of the pitfalls into which Clarke seems to have blithely swan-dived could have been avoided.

It should be pointed out that Clarke's short story "Childhood's End" served as a very loose framework for the development of the *2001* screenplay, and that his novelization of the film appeared after the fact. Further, his wide-ranging disputes with Stanley Kubrick nearly dissolved the collaboration on more than one occasion. Kubrick is a notorious film *autheur* of unlimited single-mindedness and perfectionism. Much of the originality of *2001* can be traced to him as opposed to Clarke, who was, by his own admission, reduced to the post of technical advisor.

In personally assuming the reins of the new work, Clarke breaks the most serious sequel commandment: he compromises the symbolism of the earlier work. This is the worst flaw in *Odyssey 2*, which treats its estimable original symbols and characters with a marked lack of respect. Dr. Heywood Floyd, a minor character from the original work, is the protagonist in the new book. He is treated deferentially enough, although he is not really a very engaging main character. But the two major characters from the original who reappear, HAL and Bowman, are treated with all the courtesy an annoyed patrolman might extend to a bag lady. I was appalled.

Poor, poor HAL. Clarke explains to us that HAL's malfunction in murdering several crew members on the original Jupiter probe was solely due to his preoccupation with the security of the mission. Not to fear: with a bit of therapy from a stereotypical AI type, HAL is as docile as a pussycat this time around. What a slap in the mouth.

The strength of HAL as a symbol in the original work is severely undermined in this weak and narrow interpretation. To me, HAL embodied all the dangers posed by the concept of man-made intelligence. When a conventional machine malfunctions it might stop working or work incorrectly. When a thinking machine malfunctions, however, it might become insane—and we may not realize it until it is too late. HAL was acting on irrational impulses when he terminated the crew of the Jupiter probe—any attempt to rationalize them, let alone diffuse them, desecrates HAL's original meaning. HAL's appearance in *2010: Odyssey 2* is therefore reduced to even less than a gratuitous cameo.

But this is nothing compared to what the author does to the symbol of David Bowman. Here is a character who has been immersed in the ultimate transcendental experience: he has experienced his own physical death, traveled through corridors between universes, then returned to earth as the "star child." The resurrection myth plays heavily here. Clarke now has the audacity not only to reintroduce Bowman as a character, but even allows him to recontact his old girlfriend by appearing to her inside her TV set! The reader is left to wonder about the nature of the commercials aired during his program.

Then there is Clarke's mistreatment of the monolith, which is by far the most heinous debasement of a major image from the original. I will spare you the gruesome details. Suffice to say that Clarke reduces the imagery of the monolith to a symbol with all the intrinsic worth of a "No Parking" sign.

By treating Bowman as Casper the Friendly Ghost, HAL as a woebegone Atari 800, and the monolith as an intergalactic whoopee cushion, Clarke manages to transform one of the most resplendent stories of the '60s into a segment from "Bewitched." He does, to some small credit, sandwich some new sci-fi action into the chapters describing a supplementary probe to Jupiter, tries to work in some new material discovered by Voyager, and many of his visual descriptions are vintage stuff. But these constitute precious little justification for the liberties he has taken with a now-classic story he himself knew was better left alone. *2010: Odyssey 2* does not deserve to inhabit the same universe as its predecessor. —JJA

The New Alchemists: Silicon Valley And The Microelectronics Revolution, by Dirk Hanson. Little, Brown And Company, Boston. 364 pages. $15.95. 1982.

If you only read one book about computers this year, be sure *The New Alchemists* is it. In a highly readable, non-technical style, Dirk Hanson chronicles the history of electronics from the first attempts to harness electricity in the 1800's to the age of computers skyrocketing into outer space.

From the onset, Hanson enchants the reader with anecdotes about the electrical pioneers. Thomas Edison "zapped dogs with a thousand volts of alternating current" to demonstrate the hazards of AC which a rival and competitor proposed. Nikola Tesla, the renowned electrical investigator, claimed "that he could vibrate the entire planet." Alan Turing, one of the foremost architects of the modern computer, "died at the age of 42 from suicide by poison" after being threatened with public exposure of his homosexuality. These not-to-be-found-in-the-encyclopedia

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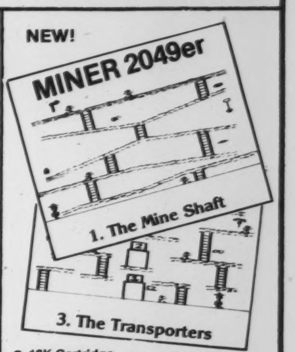

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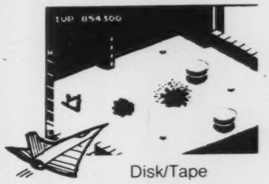

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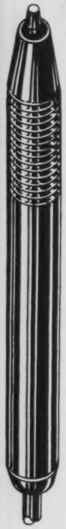

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revelations add a humane richness to the bigger than life images accorded these famed scientists.

After three chapters of historical roots, the saga accelerates, paced by its high-tech subject matter. Vacuum tubes, transistors, and Atari culminate in the transformation of the San Jose Valley from fruit orchards to the fertile hub of computer technology. "The Valley has gained a well-deserved reputation as the Florence of the information age...the densest concentration of brainpower in the world...digital circuit and computer manufacturers, Nobel Prize winners, maverick scientists, university researchers, electronic warfare specialists, and high-octane investors."

Despite its burgeoning subject matter, electronics (where fifty percent of what electrical engineers learn is outmoded within three years of graduation), *Alchemists* is remarkably inclusive. Covering the current political scene, Hanson discusses the U.S. Justice Department dismissals of the AT&T and IBM antitrust suits, which occurred as recently as January 1982. On the scientific horizons, he foresees Dick Tracy two-way wristradio communications via satellites and gram-sized artificial brains being launched into space for exploration of the cosmos. In Toward the Silicon Future, the concluding chapter, the author toys with artificial intelligence in machines that walk and talk.

City planners and business leaders who hope to establish high-technology electronics centers in their municipalities would do well to read this book. "The microelectronics industry has been a textbook example of a capitalist production engine tuned and running to near-perfection," writes Hanson. The 3000 electronic firms in Silicon Valley foster the nation's most spectacular growth and a comfortable lifestyle for residents of this affluent area, which is also known as "Porscheland."

The author outlines a simple recipe for success: mix excellent engineering schools with a good pool of labor and plenty of energy. Sprinkle liberally with entrepreneurs and venture capitalists. Let simmer in a pleasant climate. Serve—a billion dollar industry.

The New Alchemists is a fascinating exploration of the intense human drama taking place inside the microelectronics revolution. Within the next century, I forecast that technology will mandate a revised edition of *Alchemists*. In this version, the microelectronics revolution will have progressed beyond the video games of the 1980's to a new species. A silicon species, whose machine intelligence vastly surpasses the cellular, human mind!
—Edward Joyce

ABC's of Microcomputing by Linda Gail Christie and Jess W. Curry, Jr. Prentice-Hall Spectrum Books, Englewood Cliffs, NJ. 221 pages, paperback, $7.95, 1983.

As old hands at the microcomputer age, one of the hardest things for us to remember is that the novices don't share the common knowledge and vocabulary that some of us have been working with for years. And these days there are almost more novices than old hands. They find themselves bewildered by what seems intuitively obvious to us. The novices spend some time bumping their bauds into ROMfulls of floppy chips. The experience of coming up to speed can be painful. Fortunately most of them get through the period with a minimum of bloody noses and skinned shins. They would get through it a lot faster if they read this book.

ABC's is divided into standalone chapters. The reader can pick and choose as suits his whim. Thus a home user might skip the chapter Evaluating Educational Software or Is Security Really a Problem? in favor of Selecting a Printer. I found some of the chapters a bit disappointing. But then I have been at this a long time. 101 Home Computer Applications was titled artistically rather than factually. If you count word processing the club newsletter, your personal correspondence, and articles as three separate applications, then you come closer to 101. Still it forms a good starting point for a novice's daydreams. Other chapters fare better. Programming is like Writing a Novel contained one of the best discussions on organizing the programmer's job I have seen.

I do have a few more serious complaints, though in retrospect they may actually be strengths. This book has almost no illustrations and no photographs. This seems especially odd considering the clever and descriptive language of some of the chapters. I think a few photographs and a couple of cartoons would greatly enhance the value of the book. Second, the authors have studiously avoided making references to trademarks. This does avoid dating the book but I think the novice reader would be better served by discussions of such items as *VisiCalc* and CP/M.

ABC's is aimed at the adult rank beginner. It will hold little appeal to the computer literate user and is pitched at too high a level for most younger readers. It would be a good first purchase for the person who is thinking about buying a computer but doesn't know where to start.—*Stephen Kimmel* ☐

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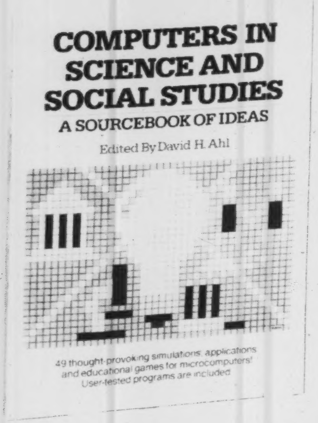
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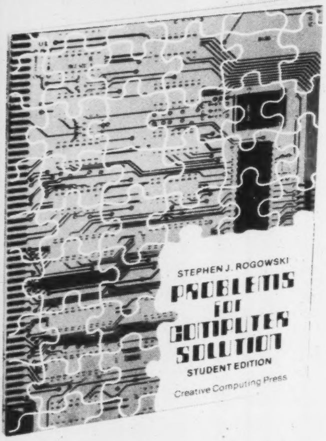
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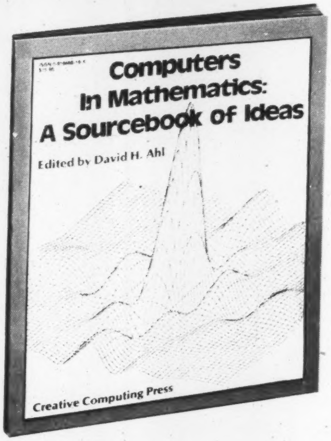
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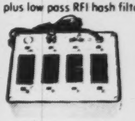

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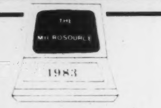

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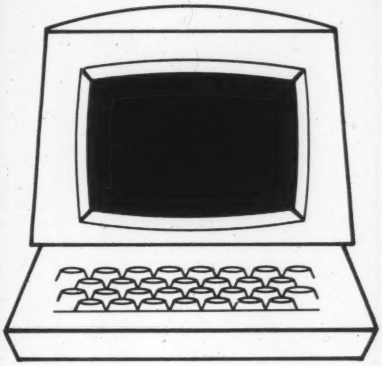

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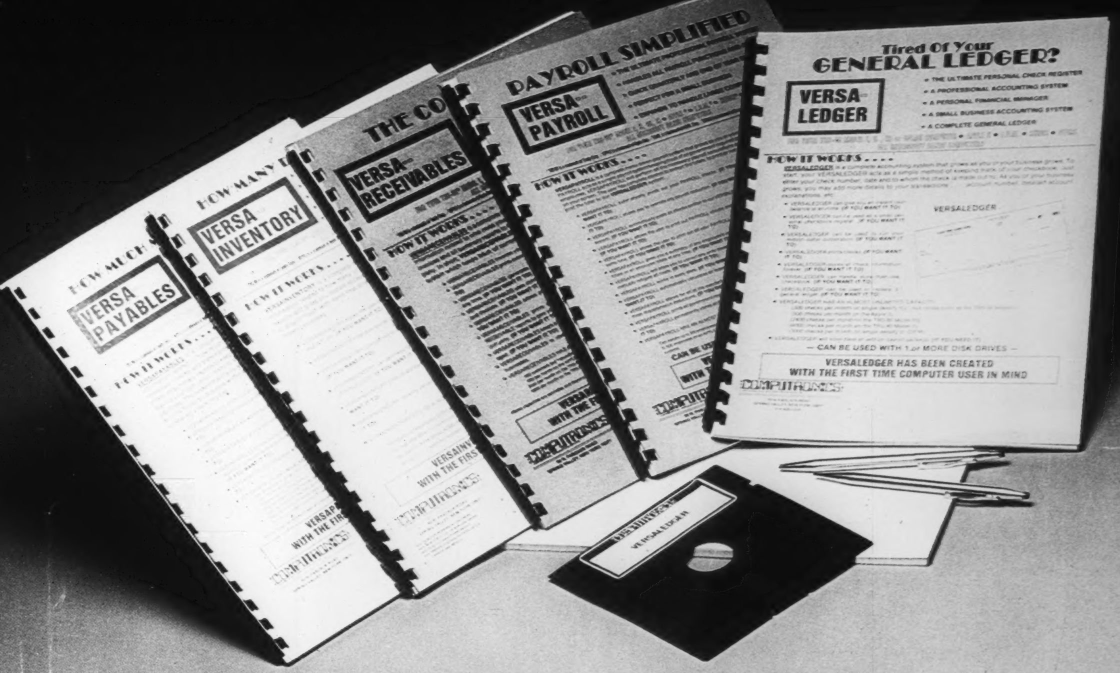

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